Notice No.8

Rules and Regulations for the Classification of Ships, July 2021

The status of this Rule set is amended as shown and is now to be read in conjunction with this and prior Notices. Any corrigenda included in the Notice are effective immediately.

Please note that corrigenda amends to paragraphs, Tables and Figures are not shown in their entirety.

Issue date: June 2022

Amendments to	Effective date	IACS/IMO implementation (if applicable)
Part 5, Chapter 1, Section 6	1 July 2022	N/A
Part 5, Chapter 2, Sections 11 & 15	1 July 2022	1 July 2022
Part 5, Chapter 12, Sections 2 & 7	1 July 2022	1 July 2022
Part 5, Chapter 13, Section 1	1 July 2022	1 July 2022
Part 5, Chapter 15, Sections 2 & 3	1 July 2022	1 July 2022
Part 5, Chapter 25, Sections 1, 3, 7, 8, 9, 10, 11, 12 & 13	1 July 2022	1 July 2022
Part 6, Chapter 2, Sections 2 & 14	1 July 2022	1 July 2022
Part 7, Chapter 11, Sections 1 & 3	1 July 2022	N/A

Part 5, Chapter 1
General Requirements for the Design and Construction of Machinery

■ *Section 6*
Quality Assurance Scheme for Machinery

6.1 General

6.1.1 The Quality Assurance Scheme for Machinery (QAM ~~Scheme~~) is an alternative to direct survey and certification of machinery components and equipment required by the Rules. Under the QAM ~~Scheme~~ LR will consider the extent to which manufacturing processes and control procedures ensure conformity of that machinery to Rules, technical specifications and any other applicable standards or codes.

6.1.2 The QAM is part of the broader Quality Assurance Engineering Schemes (QAES), which is the overarching portfolio for all audit-based survey and certification services to manufacturers. The QAM is applicable to items manufactured under closely controlled conditions. The products for which the QAM is applicable and details of how these schemes are operated are provided in LR's ShipRight Procedure *Approval of a Manufacturer according to Quality Assurance Engineering Schemes (QAES)*.

~~6.1.2 This QAM Scheme is applicable to items manufactured under closely controlled conditions. The products for which the QAM Scheme is applicable are provided in LR's ShipRight Procedure *Approval of a Manufacturer according to the Quality Assurance Scheme for Machinery* .~~

6.1.3 The QAM ~~Scheme~~ does not reduce the test requirements to be carried out in accordance with LR's Rules.

6.2 Definitions

6.2.1 The following definitions apply in the context of this Section:

6.2.2 QAM ~~Scheme~~ audit
An audit, conducted by LR at the manufacturer's, or their supplier's or sub-contractor's works, of their products and/or processes, which may include direct survey, in order to provide confidence that products are manufactured, tested and inspected in accordance with LR's Rules. Periodicity of surveillance audits is as agreed in the QAM ~~Scheme~~ Certification Schedule, *see* LR's ShipRight Procedure *Approval of a Manufacturer according to ~~the Quality Assurance Scheme for Machinery~~ Quality Assurance Engineering Schemes (QAES)*.

6.2.3 Assessment
A review, conducted by LR, of evidence gained through a number of sources, such as documentation, submitted by the manufacturer, supplier or sub-contractor, and regular QAM ~~Scheme~~ audit reports, in order to verify that products are manufactured, tested and inspected in accordance with the Rules.

6.2.4 Manufacturer
A company who contracts to supply components or equipment products to a customer or user and applies for approval under the QAM ~~Scheme~~.

6.2.5 Supplier
A company who contracts to supply materials, components or equipment products to the ~~M~~manufacturer applying for approval under the QAM ~~Scheme~~.

6.2.6 Sub-contractor
A company who contracts to deliver a service to a supplier or manufacturer under the agreed QAM ~~Scheme~~ arrangements.

6.3 QAM ~~Scheme Arrangements~~ arrangements

6.3.1 A manufacturer may apply to be approved under the QAM ~~Scheme~~ where the following requirements are met:

(a) The manufacturer has a quality management system which has been certified as meeting the requirements of ISO 9001 *Quality Management Systems - Requirements*, or an industry-specific equivalent standard, by a certification body accredited by a member of the International Accreditation Forum and recognised by LR.

(b) The manufacturer has processes in place suitable for the products to be certified under the QAM ~~Scheme~~.

(c) The manufacturer has a satisfactory and documented history of quality performance in the supply of products for which certification under the QAM ~~Scheme~~ is requested.

6.3.2 The scope and arrangements for survey, identification and certification of products covered by the QAM ~~Scheme~~ are to be agreed with LR and will be detailed in a Scheme Certification Schedule. Survey will be based on a technical audit approach, focussing on product realisation. Direct survey may also be used where it is considered appropriate to do so.

6.3.3 The QAM ~~Scheme~~ procedures given in LR's ShipRight Procedure *Approval of a Manufacturer according to ~~the Quality Assurance Scheme for Machinery~~ Quality Assurance Engineering Schemes (QAES)* are to be complied with.

6.3.4 Where LR is satisfied that the manufacturer meets all of the requirements of the QAM ~~Scheme~~, and that it is appropriate for the products being manufactured, LR will issue the manufacturer with a QAM ~~Scheme~~ Approval Certificate which will list products covered.

6.3.5 LR reserves the right to carry out unscheduled audits, with appropriate notice, at the manufacturer's works or their suppliers' and sub-contractors' works.

6.3.6 Once every three years, a full re-certification assessment of QAM ~~Scheme~~ compliance, including an audit of the manufacturer's works, will be conducted by LR.

6.3.7 The manufacturer is to advise LR of changes to the product, processes, suppliers or sub-contractors which would affect compliance with the QAM ~~Scheme~~ or LR's Rules. Any deviations from the approved plans or specifications are to be reported to LR and written approval obtained prior to dispatch of the items.

6.3.8 Where it is considered that the manufacturer no longer meets the approval requirements for the QAM ~~Scheme~~, the QAM ~~Scheme~~ Approval Certificate will be suspended. In these circumstances, the manufacturer will be notified in writing of LR's reasons for suspension of the scheme and the manufacturer will revert to direct survey ~~and issue of LR certificates~~.

6.3.9 **QAM ~~Scheme~~ product certificates** Where the manufacturer is approved according to the QAM ~~Scheme~~, they will be entitled to issue ~~'~~QAM ~~Scheme~~ product certificates~~'~~. These certificates are to clearly detail the product being certified and are to be validated by an authorised representative of the manufacturer. ~~The certificates are to be countersigned by LR to certify that the Rule requirements for that product are being met.~~ They are to bear the QAM mark, QAM approval number and statements by the manufacturer certifying that the product has been made by an approved process in accordance with the LR Rules and that the certificate is issued in accordance with the requirements of the QAM. Details regarding these statements are further described in LR's ShipRight Procedure *Approval of a Manufacturer according to Quality Assurance Engineering Schemes (QAES)*.

6.3.10 The certificate format is to be approved by LR. Variations in the wording of the statements are permitted with written approval from LR.

6.3.11 The process of issue of the certificates, including if they are electronic or hardcopy, will be agreed by LR based on the systems in place at the manufacturer.

6.3.12 Copies of all certificates are to be supplied to LR by an agreed means and frequency.

6.3.13 Where a certificate is issued according to the QAM requirements it is considered equivalent to an LR Certificate issued under direct survey.

6.4 Acceptance of purchased materials, components and equipment

6.4.1 The manufacturer is to establish and maintain procedures and controls to ensure compliance with LR's requirements for certification of products from its suppliers. The manufacturer is to ensure that purchased products that are required to be certified in accordance with *Ch 3 Rolled Steel Plates, Strip, Sections and Bars* to *Ch 10 Equipment for Mooring and Anchoring* of the ~~Rules for Materials~~ *Rules for the Manufacture, Testing and Certification of Materials* are made at works which have been approved by LR for the type and grade of product being supplied. The manufacturer's system for control of purchased products is to be based on one or a combination of the following alternatives:

(a) Product certification by LR at the supplier's works in accordance with the requirements of the Rules.

(b) Product certification by a supplier separately approved by LR under the QAM ~~Scheme~~ or other LR Quality Scheme covering those products.

(c) Product certification by the supplier in accordance with quality processes for control of suppliers of purchased products included within the scope of the manufacturer's QAM ~~Scheme~~ approval. These quality schemes are to ensure compliance with Rule requirements for the purchased products.

6.4.2 **Manufacturers' certificates issued under the QAM ~~Scheme~~**

Where the manufacturer's system for control of purchased products from suppliers is based on paragraph *Pt 5, Ch 1, 6.4 Acceptance of purchased materials, components and equipment 6.4.1.(c)* and Surveyors have confirmed that LR Rules are being satisfied, in lieu of LR Certificates for purchased products, the manufacturer will be permitted to accept 'Manufacturers' certificates issued under the QAM ~~Scheme~~'. They are to bear the QAM mark, QAM approval number and statements by the manufacturer certifying that the product has been made by an approved process in accordance with LR's Rules and that the certificate is issued in accordance with the requirements of the QAM. Details regarding these statements are further described in LR's ShipRight Procedure *Approval of a Manufacturer according to Quality Assurance Engineering Schemes (QAES)*. ~~The certificates must bear the QAM Scheme mark and the following statement:~~

~~"This certificate is issued under the arrangements authorised by Lloyd's Register (operating entity, e.g. EMEA) in accordance with the requirements of the Quality Assurance Scheme for Machinery and Scheme number, QAM……."~~

Variations in the wording of the statements are permitted with written approval from LR.

Part 5, Chapter 2,
Reciprocating Internal Combustion Engines

■ *Section 11*

Factory Acceptance Test and Shipboard Trials of Engines

11.3 Work trials (factory acceptance test)

(Part only shown)

Table 2.11.1 Scope of works trials for engines

Main engines driving propellers and water jets		
Trial condition	Duration	Note
100 per cent power (rated power) at rated engine speed, *R*	≥ 60 minutes	*see* Note 5
110 per cent power at engine speed corresponding to ~~1,032**R*~~ 1,032*R*	15 minutes	Or after having reached steady conditions, whichever is shorter, *see* Notes 1 ~~and~~, 4 and 5 For DF engines, this may be demonstrated in diesel mode.
90 per cent (or normal continuous power), 75 per cent, 50 per cent and 25 per cent power	—	Engine speed in accordance with the nominal propeller curve, sequence to be selected by the manufacturer, *see* Note 5 For DF engines, the load tests are to be carried out in gas mode at the different percentages of the maximum available power.
Engines driving generators for electric propulsion or driving generators for auxiliary purposes		
Trial condition	Duration	Note ~~Note~~
100 per cent power (rated power) at rated engine speed, *R*	≥ 60 minutes	*see* Note 5
110 per cent power	15 minutes	Or after having reached steady conditions, *see* Note 2. For auxiliary engines, *see* Notes 1 and 5 For DF engines, this may be demonstrated in diesel mode. ~~5~~
75 per cent, 50 per cent and 25 per cent power and idle run	—	*see* Notes 2 and 5 For DF engines, the load tests are to be carried out in gas mode at the different percentages of the maximum available power.
Propulsion engines driving power take off (PTO) generator		
Trial condition	Duration	Note
100 per cent power (rated power) at rated engine speed, *R*	≥ 60 minutes	~~/~~ *See* Note 5
110 per cent power	15 minutes	Or after having reached steady conditions, *see* Notes 3 and 5 For DF engines, this may be demonstrated in diesel mode.
90 per cent (~~of~~ or normal continuous power), 75 per cent, 50 per cent and 25 per cent power	—	Engine speed in accordance with the nominal propeller curve or at constant speed *R*, sequence to be selected by the manufacturer, *see* Note 5 For DF engines, the load tests are to be carried out in gas mode at the different percentages of the maximum available power.
Engines driving mechanical auxiliaries		
Trial condition	Duration	Note
100 per cent power (rated power) at rated engine speed, *R*	≥ 30 minutes	For DF engines, this may be demonstrated in diesel mode. *See* Note 5
110 per cent power	15 minutes	Or after having reached steady conditions, *see* Notes 1 and 5 For DF engines, this may be demonstrated in diesel mode.
75 per cent, 50 per cent and 25 per cent power	—	Engine speed in accordance with the nominal power consumption curve, sequence to be selected by the manufacturer, *see* Note 5 For DF engines, the load tests are to be carried out in gas mode at the different percentages of the maximum available power.
Note 5. The gas methane number (where applicable) during the test is to be recorded. The test should demonstrate that the engine reaches the declared power output with the given methane number.		

11.4 Shipboard trials

(Part only shown)

Table 2.11.2 Scope of shipboard trials for engines

Main engines driving fixed-pitch propeller or ~~waterjet~~ water jet (*see* Note 1)		
Trial condition	Duration	Note ~~Note~~
At rated engine speed, *R*	≥ 4 hours	≠ *See* Note 6
At engine speed corresponding to ~~1,032**R*~~ 1,032R	30 minutes	Where the engine adjustment permits, *see Pt 5, Ch 2, 11.2 General 11.2.7*, *see* Note 6 For DF engines, this may be demonstrated in diesel mode
Main engines driving controllable pitch propellers		
Trial condition	Duration	Note
At 100 per cent power	≥ 4 hours	*See* Notes 2 and 6
Engine(s) driving generator(s) for electrical propulsion and/or main power supply		
Trial condition	Duration	Note ~~Note~~
100 per cent power (rated electrical power of generator)	≥ 60 minutes	*See* Notes 3 ~~and~~ ,4 and 6
110 per cent power (rated electrical power of generator)	≥ 10 minutes	*See* Note 4 and 6 For DF engines, this may be demonstrated in diesel mode
Starting manoeuvres	–	*See* Note 5
Control, monitoring, alarm and safety systems	–	Operation to be demonstrated
Demonstration of the generator prime movers' and governors' ability to handle load steps	–	See *Pt 5, Ch 2, 7.3 Auxiliary and emergency engine governors*
Propulsion engines driving power take off (PTO) generator		
Trial condition	Duration	Note
100 per cent engine power (MCR) at corresponding speed, *R*	≥ 4 hour	≠ *See* Note 6
100 per cent propeller branch power at engine speed, *R* (unless already covered above)	2 hours	≠ *See* Note 6
100 per cent PTO branch power at engine speed, *R*	≥ 1 hour	≠ *See* Note 6
Control, monitoring, alarm and safety systems	-	Operation to be demonstrated
Engines driving mechanical auxiliaries		
Trial condition	Duration	Note
100 per cent engine power (MCR) at corresponding speed, *R*	≥ 30 minutes	≠ *See* Note 6
Approved intermittent overload (if applicable)	–	Testing for duration as approved
Control, monitoring, alarm and safety systems	–	Operation to be demonstrated
Note 6. Gas methane number during the test is to be recorded. The test should demonstrate that the engine reaches the declared power output with the given methane number.		

■ *Section 15*
Engines supplied with low pressure gas

15.1.5 For DF and GF engines, the maximum power available in gas mode and the corresponding conditions shall be stated by the engine manufacturer and demonstrated during the type test. The gas methane number during the test is to be recorded. The test should be performed with the minimum methane number acceptable by the engine without leading to engine derating. Type testing requirements are given in LR's *Type Approval System Test Specification Number 4*.

Part 5, Chapter 12
Piping Design Requirements

■ *Section 2*
Carbon and low alloy steels

2.2 Wrought steel pipes and bends

2.2.9 Reinforced thickness of ballast and cargo oil piping. Ballast piping passing through cargo tanks and cargo oil pipes passing through segregated ballast tanks, as permitted by Regulation 19.3.6 of MARPOL Annex I, are to comply with the following requirements.

(a) The pipes are to be of heavy gauge steel of minimum wall thickness according to the *Table 12.2.9 Reinforced thickness of ballast and cargo oil piping*, with welded or heavy flanged joints the number of which is to be kept to a minimum.

(b) Expansion bends only (not glands) are permitted in these lines within cargo tanks for serving the ballast tanks and within ballast tanks for serving the cargo tanks.

Table 12.2.5 Reinforced thickness of ballast and cargo oil piping

Nominal diameter(mm)	Minimum wall thickness (mm)
50	6,3
100	8,6
125	9,5
150	11,0
200 and above	12,5

2.2.10 The thicknesses shown in the above table refer to carbon steel.

2.12 Other mechanical couplings

Existing Table 12.2.7 has been deleted and replaced with below.

Table 12.2.8 Application of mechanical joints

Systems	Kind of connections				
	Pipe unions	Compression couplings	Slip-on joints	Classification of pipe system	Fire endurance test condition, *see* Note 7
Flammable fluids (flash point ≤ 60°C)					
Cargo oil lines, *see* Note 1	+	+	+	dry	30 min dry (*)
Crude oil washing lines, *see* Note 1	+	+	+	dry	30 min dry (*)
Vent lines, *see* Note 3	+	+	+	dry	30 min dry (*)
Inert gas					
Water seal effluent lines	+	+	+	wet	30 min wet (*)
Scrubber effluent lines	+	+	+	wet	30 min wet (*)
Main lines, *see* Notes 1 & 2	+	+	+	dry	30 min dry (*)
Distributions lines, *see* Note 1	+	+	+	dry	30 min dry (*)
Flammable fluids (flash point > 60°C)					
Cargo oil lines, *see* Note 1	+	+	+	dry	30 min dry (*)
Fuel oil lines, *see* Notes 2 & 3	+	+	+	wet	30 min wet (*)
Lubricating oil lines, *see* Notes 2 & 3	+	+	+	wet	
Hydraulic oil, *see* Notes 2 & 3	+	+	+	wet	
Thermal oil, *see* Notes 2 & 3	+	+	+	wet	
Sea water					
Bilge lines, *see* Note 4	+	+	+	dry/wet	8 min dry + 22 min wet (*)
Permanent water filled fire-extinguishing systems, e.g. fire main, sprinkler systems, *see* Note 3	+	+	+	wet	30 min wet (*)
Non-permanent water filled fire-extinguishing systems, e.g. foam, drencher systems and fire main, *see* Note 3	+	+	+	dry/wet	8 min dry + 22 min wet (*) For foam systems FSS Code to be observed
Ballast system, *see* Note 4	+	+	+	wet	30 min wet (*)
Cooling water system, *see* Note 4	+	+	+	wet	30 min wet (*)
Tank cleaning services	+	+	+	dry	Fire endurance test not required

Non-essential systems	+	+	+	dry, dry/wet, wet	Fire endurance test not required
Fresh water					
Cooling water system, *see* Note 4	+	+	+	dry	Fire endurance test not required
Condensate return, *see* Note 4	+	+	+	dry	
Non-essential system	+	+	+	dry	
Sanitary/drains/scuppers					
Deck drains (internal), *see* Note 5	+	+	+	dry	Fire endurance test not required
Sanitary drains	+	+	+	dry	
Scuppers and discharge (overboard)	+	+	-	dry	
Sounding/vent					
Water tanks/dry spaces	+	+	+	dry, wet	Fire endurance test not required
Oil tanks (f.p. > 60°C), *see* Notes 2 & 3	+	+	+	dry	
Miscellaneous					
Starting/control air, *see* Note 4	+	+	-	dry	30 min dry (*)
Service air (non-essential)	+	+	+	dry	Fire endurance test not required
Brine	+	+	+	wet	
CO_2 system (outside protected space)	+	+	-	dry	30 min dry (*)
CO_2 system (inside protected space)	+	+	-	dry	Mechanical joints shall be constructed of materials with a melting point above 925°C. Ref. to FSS Code Chapter 5.
Steam	+	+	+ *see* Note 8	wet	Fire endurance test not required

Abbreviations:
+ Application is allowed.
- Application is not allowed.
* Fire endurance test as specified in LR's *Test Specification No. 2, Ch 5, Appendix 4 – Mechanical pipe joints – Fixed connections, 4.2.7*.

If mechanical joints include any components which readily deteriorate in case of fire, the following footnotes are to be observed:
Note *1*. A fire endurance test shall be applied when mechanical joints are installed in pump-rooms and open decks.
Note *2*. Slip-on joints are not accepted inside machinery spaces of category A or accommodation spaces. They may be accepted in other machinery spaces provided the joints are located in easily visible and accessible positions (refer to MSC/Circ.734).
Note *3*. Mechanical joints are to be of approved fire-resistant types except in cases where such mechanical joints are installed on open decks, as defined in SOLAS Chapter II-2, Regulation 9.2.3.3.2.2(10), and not used for fuel oil lines.
Note *4*. A fire endurance test shall be applied when mechanical joints are installed inside machinery spaces of category A.
Note *5*. Only above bulkhead deck of passenger ships and freeboard deck of cargo ships.
Note *6*. Slip type slip-on joints as shown in *Figure 12.2.4 Examples of mechanical joints (Part 1)* and *Figure 12.2.5 Examples of mechanical joints (Part 2)* may be used for pipes on deck with a design pressure of 10 bar or less.
Note *7*. If a connection has passed the '30 min dry' test, it is considered suitable also for applications for which the '8 min dry + 22 min wet' and/or '30 min wet' tests are required. If a connection has passed the '8 min dry + 22 min wet' test, it is considered suitable also for applications for which the '30 min wet' test is required.
Note *8*. *See Pt 5, Ch12, 2.12 Other mechanical couplings 2.12.10.*

■ *Section 7*
Flexible hoses

7.1 General

7.1.4 Flexible hoses are to be limited to a length necessary to provide for relative movement between fixed and flexibly mounted items of machinery/equipment or systems. Flexible hose assemblies for essential services or containing either flammable or toxic substances are not to exceed 1,5 m in length.

Part 5, Chapter 13
Ship Piping Systems

■ *Section 1*
General requirements

1.2 Prevention of progressive flooding in damage condition

1.2.4 Protection from mechanical damage. Sea water pipes in cargo holds for dry cargoes, including cargo spaces of container ships and ro-ro ships, are to be protected from impact of cargo where they are liable to be damaged.

Part 5, Chapter 15
Piping Systems for Oil Tankers

■ *Section 2*
Piping systems for bilge, ballast, fuel oil, etc.

2.4 Drainage of ballast tanks and void spaces within the range of the cargo tanks

2.4.4 Ballast piping is normally not to pass through cargo tanks and is not to be connected to cargo oil piping. Provision may, however, be made for emergency discharge of water ballast by means of a portable spool connection to a cargo oil pump and where this is arranged, a non-return valve is to be fitted in the ballast suction to the cargo oil pump.

2.4.5 The portable spool piece should be mounted in a conspicuous position in the pump-room and a permanent notice restricting its use should be prominently displayed adjacent to it.

2.4.6 Shut-off valves shall be provided to shut off the cargo and ballast lines before the spool piece is removed.

2.4.7 The ballast pump is to be located in the cargo pump-room, or a similar space within the cargo area not containing any source of ignition.

Existing paragraph 2.4.5 has been renumbered 2.4.8.

■ *Section 3*
Cargo handling system

3.3 Cargo piping system

3.3.1 Cargo piping and similar piping to cargo tanks are normally not to pass through ballast tanks unless specially approved as per *Pt 5, Ch 12, 2.2 Wrought steel pipes and bends 2.2.9*.

Part 5, Chapter 25
Ballast Water Treatment System and Installation

■ *Section 1*
General

1.2 Definitions

1.2.3 ~~**Ballast Water Treatment System** – is the arrangement in place for the purpose of treating ballast water, collecting samples, and analysing discharge (if fitted). It includes piping and fittings, equipment, treatment techniques and an electrical and control system.~~ **Ballast Water Treatment System** (hereinafter referred to as '**BWTS**') **–** any system which processes ballast water such that it meets or exceeds the

Ballast Water Performance Standard in Regulation D-2 of *The International Convention for the Control and Management of Ships' Ballast Water and Sediments* (BWM Convention). The BWTS includes ballast water equipment, all associated piping arrangements as specified by the manufacturer, control and monitoring equipment, and sampling facilities. The categorisation of BWTS technologies is given in *Table 25.1.1 Categorisation of BWTS technologies*.

Table 25.1.1 Categorisation of BWTS technologies

BWTS category		1	2	3a	3b	3c	4	5	6	7a	7b	8
Characteristics												
Dis-infection when ballasting	Making use of active substance		X			*See* Note 3	X	X	X	X	X	*See* Note 3
	Full flow of ballast water is passing through the BWTS	X	X	X	X		X				X	
	Only a small part of ballast water is passing through the BWTS to generate the active substance							X				
After-treatment when de-ballasting	Full flow of ballast water is passing through the BWTS	X									X	
	Injection of neutraliser						X	X	X	X	X	
	Not required by the Type Approval Certificate issued by the Administration		X	X								
Examples of dangerous gas as defined in *Pt 5, Ch 25, 1.2 Definitions 1.2.5*			*See* Note 1	O_2 N_2		CO_2 CO	H_2 Cl_2	H_2 Cl_2	*See* Note 1	O_2 O_3 N_2		O_2 N_2

Note 1. To be investigated on a case-by-case basis based on the result of the IMO (GESAMP) MEPC report for basic and final approval in accordance with the G9 Guideline.
Note 2. In-line side-stream electrolysis may also be applied in-tank in circulation mode (no treatment when ballasting or de-ballasting).
Note 3. In-tank technology: No treatment when ballasting or de-ballasting.

BWTS category	BWTS Technologies
1	In-line UV or UV + Advanced Oxidation Technology (AOT) or UV + TiO2 or UV + Plasma
2	In-line flocculation
3a	In-line membrane separation and de-oxygenation (injection of N2 from a N2 generator)
3b	In-line de-oxygenation (injection of inert gas from inert gas generator)
3c	In-tank de-oxygenation with Inert gas generator
4	In-line full flow electrolysis
5	In-line side stream electrolysis (*see* Note 2)
6	In-line (stored) chemical injection
7a	In-line side-stream ozone injection without gas/liquid separation tank and without discharge treatment tank
7b	In-line side-stream ozone injection with gas/liquid separation tank and discharge water treatment tank
8	In-tank pasteurisation and de-oxygenation with N2 generator

1.2.5 ~~**Dangerous gas –** refers to any gas which may develop an explosive and/or toxic atmosphere, e.g. hydrogen (H_2), hydrogen sulphide (H_2S), hydrocarbon gas, ozone (O_3), chlorine (Cl_2), chlorine dioxide (ClO_2), etc.~~ **Dangerous gas –** any gas which may develop an atmosphere being hazardous to the crew and/or the ship due to flammability, explosivity, toxicity, asphyxiation, corrosivity or reactivity and for which due consideration of the hazards is required, e.g. hydrogen (H_2), hydrocarbon gas, oxygen (O_2), carbon dioxide (CO_2), carbon monoxide (CO), ozone (O_3), chlorine (Cl_2) and chlorine dioxide (ClO_2), etc.

1.2.6 **Dangerous liquid –** any liquid that is identified as hazardous in the Material Safety Data Sheet or other documentation relating to this liquid.

Existing paragraphs 1.2.6 and 1.2.7 have been renumbered 1.2.7 and 1.2.8.

1.2.9 **Non-hazardous area –** an area which is not a hazardous area as defined in above paragraph.

Existing paragraphs 1.2.9 to 1.2.17 have been renumbered 1.2.10 to 1.2.19.

1.2.20 The Safe locations for the various discharges are shown below and signboards or similar warnings at the discharge areas are to be provided.

(a) **Safe location (1) Inert gas or nitrogen product enriched air**

Sources of inert gas or nitrogen product enriched air include:

- in-line (categories 3a and 3b) and in-tank (categories 3c and 8) de-oxygenation BWTS: the protection devices installed on the ballast tanks, nitrogen or inert gas generators, nitrogen buffer tank (if any); or
- in-line ozone injection BWTS (categories 7a and 7b): the oxygen generator;

Safe locations on the open deck are:

- not within 3 m of areas traversed by personnel; and
- not within 6 m of air intakes for machinery (engines and boilers) and all ventilation inlets/outlets.

(b) **Safe location (2) Oxygen-enriched air**

Sources of oxygen-enriched air include:

- in-line and in-tank de-oxygenation BWTS (categories 3a and 8): the nitrogen generator; or
- in-line ozone injection BWTS (categories 7a and 7b): the protection devices or vents from oxygen generator, compressed oxygen vessel, the ozone generator and ozone destructor devices;

Safe locations on the open deck are:

- outside of hazardous area;
- not within 3 m of any source of ignition and deck machinery, which may include anchor windlass and chain locker openings, and equipment which may constitute an ignition hazard;
- not within 3 m of areas traversed by personnel; and
- not within 6 m of air intakes for machinery (engines and boilers) and all ventilation inlets.

(c) **Safe location (3) Hydrogen by-product enriched gas**

Sources of hydrogen by-product enriched gas include:

- in-line full flow electrolysis BWTS (category 4), in-line side-stream electrolysis BWTS (category 5) and in-line injection BWTS using a chemical which is stored on board (category 6): the hydrogen de-gas arrangement (when provided);

Safe locations on the open deck are:

- not within 5 m of any source of ignition and deck machinery, which may include anchor windlass and chain locker openings, and equipment which may constitute an ignition hazard;
- not within 3 m of areas traversed by personnel; and
- not within 5 m of air intakes from non-hazardous enclosed spaces.

The areas on the open deck, or semi-enclosed spaces on the open deck, within 3 m of the outlets are to be categorised hazardous Zone 1, and an additional 1,5 m surrounding the 3 m hazardous Zone 1 is to be categorised hazardous Zone 2. Electrical apparatus located in the above hazardous areas Zone 1 and Zone 2 is to be suitable for at least IIC T1.

(d) **Safe location (4) Ozone**

For in-line ozone injection BWTS (categories 7a and 7b), vent outlet from the O_3 destructor device (ODS) can be considered as Oxygen-enriched Air provided that:

- the ODS is duplicated;
- the manufacturer justified that the quantity of consumable (activated carbon) used by the ODS is sufficient for the considered life cycle of the BWTS; and
- ozone detection is arranged in the vicinity of the discharge outlet from the vent outlet of the ODS to alert the crew in case the ODS is not working.

If one of the above three conditions is not fulfilled, the safe locations from the ODS on the open deck are:

- outside of hazardous area;
- not within 3 m of any source of ignition;
- not within 6 m of areas traversed by personnel; and
- not within 6 m of air intakes for machinery (engines and boilers) and all ventilation inlets.

1.2.21 **Airlock** - an airlock is a space enclosed by gastight steel bulkheads with two gastight doors spaced not more than 2,5 m apart. The doors shall be self-closing without any holding back arrangements. Airlocks are to have mechanical ventilation and are not to be used for other purposes. An audible and visual alarm system to give a warning on both sides of the airlock is to be provided to indicate if more than one door is moved from the closed position. The airlock space is to be monitored for dangerous gas as defined in *Pt 5, Ch 25, 1.2 Definitions*.

1.2.22 **Ballast Water Treatment Room (BWTR) -** a Ballast Water Treatment Room is any space containing equipment belonging to the Ballast Water Treatment System. A space containing remote controls for the BWTS or a space dedicated to the storage of liquid or solid chemicals for BWTS need not be considered as a BWTR for the purposes of this Section.

1.2.23 **Flammable liquid** – a liquid whose flash point does not exceed 38°, when tested by closed-cup test methods.

■ *Section 3*
Performance requirements

3.1 General

3.1.1 ~~The BWTS is to be able to treat the ballast capacity of the vessel. The ballast capacity shall be described either in terms of flowrate or volume depending on the type of BWTS.~~The BWTS is to be chosen taking into account the BWT'S operational capacity and limiting conditions. *See Pt 5, Ch 1, 3.1 Availability for operation 3.1.3.* The BWTS is to be able to treat the ballast capacity of the vessel. The ballast capacity is to be described either in terms of flowrate or volume depending on the type of BWTS.

3.1.2 ~~Where it is possible that a vacuum may occur in the ballast line, a suitable means of protection is to be provided, e.g. Pressure/Vacuum (P/V) valves or breather valves. For such ballast lines from ballast tanks in hazardous areas, P/V or breather valve outlets are to be led to an area on open deck with no ignition hazard.~~The BWTS is to be designed for normal worldwide service unless stated otherwise. Particular attention must be given to the ambient air temperature as required in *Pt 3, Ch 2 Grades of steel 2.1.4*.

Existing paragraph 3.1.6 has been deleted, remaining paragraphs have been renumbered.

■ *Section 7*
Piping Systems

~~7.2 Side stream piping~~

Existing sub-Section 7.2 has been deleted in its entirety.

■ *Section 8*
Mechanical equipment and components

8.2 Filtering Units

8.2.4 Where filters are provided with a by-pass arrangement in accordance with ~~*Pt 5, Ch 25, 11.2 By-pass and isolation*~~ *Pt 5, Ch 25, 11 General requirements 11.1.3*, above requirements *Pt 5, Ch 25, 8.2 Filtering units 8.2.2* and *Pt 5, Ch 25, 8.2 Filtering units 8.2.3* may be exempted.

8.3 Other components

~~8.3.1 Inert gas systems are to meet the technical requirements of *Pt 5, Ch 15, 7 Inert gas systems on Tankers of 8,000 tonnes DWT and above*, as applicable.~~

Existing paragraphs 8.3.2 and 8.3.3 have been renumbered.

■ *Section 9*
Electrotechnical ~~Systems~~systems

9.1 General

9.1.4 ~~Gas detection equipment is to be designed, installed and tested in accordance with *IEC 60079-29-2: Explosive atmospheres Part 29-2: Gas detectors — Selection, installation, use and maintenance of detectors for flammable gases and oxygen*, and is to be suitable for the gases to be detected.~~ For flammable gases and explosive atmospheres including but not limited to hydrogen (H_2), the construction, testing and performance of the gas detection devices is to be in accordance with IEC 60079-29-1, IEC 60079-29-2, IEC 60079-29-3 and/or IEC 60079-29-4, as applicable. Where other hazards are considered, such as toxicity, asphyxiation, corrosive and reactivity hazards, a recognised standard acceptable to LR is to be selected with due consideration of the specific gases to be detected and due consideration of the performance of the detection device with regards to the specific atmosphere where it is used.

9.1.12 When it is required to have an automatic shutdown of the BWTS for safety reasons, this must be achieved by a safety system that is functionally independent of the BWTS control system as far as practicable.

9.1.13 Equipment protection

(a) Protection is to be installed to protect UV type BWTS in accordance with *Pt 6, Ch 2, 6 System design - Protection*.

(b) Electrolysis reactors are to be provided with at least two independent means of monitoring their operation. The monitoring system is to initiate audible and visual alarms in all stations from which the ballast water operations are controlled and automatic shutdown of the BWTS in the event that an anomaly is detected. Requirements for shutdown arrangement are clarified in *Pt 5, Ch 25, 11.1 General requirements 11.1.5.*

Note: If a pressure relief valve is also provided, the vent of this valve is to be led to a safe location on the open deck, as specified in *Pt 5, Ch 25, 1.2 Definitions*. The valve is to be positioned to optimally remove gas from the electrolysis reactor.

■ *Section 10*

~~Structural and Space categorisation requirements~~Ballast water treatment room location and boundaries

~~**10.2 Ballast tank requirements**~~

Existing sub-Section 10.2 has been deleted in its entirety.

Existing sub-Section 10.3 has been renumbered 10.2.

Sub-Section 10.3 has been deleted and replaced with the following:

~~10.3~~ 10.2 ~~Chemical storage tank requirements~~Ballast water treatment room location and boundaries

10.2.1 **BWTS using chemical substances**

(a) For BWTS storing, introducing or generating chemicals, the BWTR and chemical substance storage rooms are not to be located in the accommodation area. Any ventilation exhaust or other openings from these rooms is to be located not less than 3 m from entrances, air inlets and openings to accommodation spaces.

This requirement need not apply in a case where the BWTS is located in the engine room.

10.2.2 **Ozone-based BWTS**

(a) Ozone-based BWTS – i.e. category 7a and 7b as per *Table 25.1.1 Categorisation of BWTS technologies* – are to be located in a dedicated compartment, separated from any other space by gastight boundaries. Access to the BWTR from any other enclosed space shall be through airlock only, except if the only access to that space is from the open deck.

Access to the ozone-based BWTR may only be provided through the engine room if:

- Access from the engine room to the BWTR is through an airlock; and
- An alarm repeater is provided in the BWTR, which will repeat any alarm activated in the engine room.

(b) A sign shall be affixed to the door providing personnel with a warning that ozone may be present and with the necessary instructions to be followed before entering the room.

10.2.3 **General**

(a) BWTR containing equipment for BWTS of the following types is to be equipped with tested gastight and self-closing doors without any holding back arrangements:

- BWTS storing, introducing or generating chemical substances;
- De-oxygenation based on inert gas generator;
- Electrolysis;
- Ozone injection.

Doors leading to the open deck, however, need not be self-closing.

Existing sub-Section 10.4 has been deleted and replaced with the following;

10.3 Ventilation

10.3.1 Ventilation arrangement

(a) The ventilation systems for BWTR containing BWTS of the following types is to be independent of the ventilation systems serving any other spaces:

- BWTS storing, introducing or generating chemical substances;
- De-oxygenation, including pasteurisation and de-oxygenation (category and category 8 as per *Table 25.1.1 Categorisation of BWTS technologies*);
- Electrolysis;
- Ozone injection.

(b) The ventilation exhaust for BWTR containing a nitrogen generator is to be located in the lower part of the room in order to efficiently evacuate dangerous gases – as defined in *Pt 5, Ch 25, 1.2 Definitions* – heavier than air.

(c) The ventilation exhaust for BWTR containing electrolysis systems is to be located so as to be able to efficiently evacuate dangerous gases – as defined in *Pt 5, Ch 25, 1.2 Definitions* – that could be generated during the electrolysis process. Due regard is to be paid to the expected quantity and density of such gases when designing the ventilation exhaust.

(d) The following requirements apply to ventilation ducts serving BWTR for ozone-based BWTS:

- The part of the ducts located outside of the BWTR are to be made of steel having a thickness of at least 3 mm for ducts with a free cross-sectional area of less than 0,075 m^2, at least 4 mm for ducts with a free cross-sectional area of between 0,075 m^2 and 0,45 m^2, and at least 5 mm for ducts with a free cross-sectional area of over 0,45 m^2;
- The ducts are to be suitably supported and stiffened; and
- The outside openings of the ducts are to be fitted with protective screens of not more than 13 mm square mesh.

(e) The ventilation system for BWTR containing ozone-based BWTS or the ventilation system for hydrogen de-gas arrangement as required by *Pt 5, Ch 25, 11.3 Special requirements for BWTS generating dangerous gas or dealing with dangerous liquids, 11.3.1 (e)* is to be interlocked with the BWTS such that:

- In case of loss of ventilation (primary and secondary), a visual and audible alarm is to be triggered both inside and outside the BWTR and at a place where a responsible member of the crew is on duty. If the ventilation is not restored after a pre-set time, the BWTS is then automatically shut down. Any need for cooldown necessary for safe shutdown is to be considered in the shutdown sequence.
- It is not to be possible to start the BWTS without the ventilation running.

For ventilation systems serving BWTR and containing or conveying a dangerous gas, the relevant requirements in *Pt 5, Ch 25, 11.3 Special requirements for BWTS generating dangerous gas or dealing with dangerous liquids* are to be satisfied.

10.3.2 Ventilation rate

(a) An adequate power ventilation system is to be provided in enclosed BWTR.

(b) The ventilation capacity is to be at least 30 air changes per hour where explosive or toxic gases may be generated during operation of the BWTS.

(c) The ventilation capacity may be reduced as follows:

- Flocculation-type BWTS — 6 air changes per hour
- De-oxygenation, including pasteurisation and de-oxygenation (category 3 and category 8 as per *Table 25.1.1 Categorisation of BWTS technologies*) — 6 air changes per hour
- Full flow electrolysis — 6 air changes per hour
- Side-stream electrolysis — 20 air changes per hour
- Ozone injection — 20 air changes per hour
- Chemical injection — 6 air changes per hour

Note More stringent ventilation capacity requirements may arise from other regulations, e.g. IBC Code requirements for spaces located in the cargo area.

■ *Section 11*
System arrangement requirements

11.1 General requirements

1.11.1 The BWTS arrangement is to satisfy the requirements of this Section as applicable. The applicability of the requirements for each BWTS technology is to be in accordance with *Table 25.11.1 Applicability of the requirements for each BWTS technology*.

Table 25.11.1 Applicability of the requirements for each BWTS technology

BWTS category	1	2	3a	3b	3c	4	5	6	7a	7b	8
Pt 5, Ch 25,11.1 General requirements 11.1.1 to *Pt 5, Ch 25,11.1 General requirements 11.1.7*	x	x	x	x	x	x	x	x	x	x	x
Pt 5, Ch 25,11.1 General requirements 11.1.8 to *Pt 5, Ch 25,11.1 General requirements 11.1.11*			x	x	x						x
Pt 5, Ch 25,11.1 General requirements 11.1.12	x	x	x	x	x	x	x	x	x	x	x
Pt 5, Ch 25,11.1 General requirements 11.1.13			x	x	x						x
Pt 5, Ch 25,11.1 General requirements 11.1.14				x						x	
Pt 5, Ch 25, 11.2 Additional requirements for tankers 11.2.2				x	x				x	x	
Pt 5, Ch 25, 11.2 Additional requirements for tankers 11.2.3						x	x	x			
Pt 5, Ch 25, 11.2 Additional requirements for tankers 11.2.4 and *Pt 5, Ch 25, 11.2 Additional requirements for tankers 11.2.5*	x	x	x	x		x	x	x	x	x	
Pt 5, Ch 25, 11.2 Additional requirements for tankers 11.2.6	x	x	x	x	x	x	x	x	x	x	x
Pt 5, Ch 25, 11.2 Additional requirements for tankers 11.2.7	x	x	x	x		x	x	x	x	x	

Pt 5, Ch 25, 11.3 Special requirements for BWTS generating dangerous gas or dealing with dangerous liquids (categories 2, 3a, 3b, 3c, 4, 5, 6, 7a, 7b and 8) 11.3.1 (a)		x	x			x	x	x	x	x	x
Pt 5, Ch 25, 11.3 Special requirements for BWTS generating dangerous gas or dealing with dangerous liquids (categories 2, 3a, 3b, 3c, 4, 5, 6, 7a, 7b and 8) 11.3.1 (b)			x	x	x				x	x	x
Pt 5, Ch 25, 11.3 Special requirements for BWTS generating dangerous gas or dealing with dangerous liquids (categories 2, 3a, 3b, 3c, 4, 5, 6, 7a, 7b and 8) 11.3.1 (c)									x	x	
Pt 5, Ch 25, 11.3 Special requirements for BWTS generating dangerous gas or dealing with dangerous liquids (categories 2, 3a, 3b, 3c, 4, 5, 6, 7a, 7b and 8) 11.3.1 (d)						x	x	x	x	x	
Pt 5, Ch 25, 11.3 Special requirements for BWTS generating dangerous gas or dealing with dangerous liquids (categories 2, 3a, 3b, 3c, 4, 5, 6, 7a, 7b and 8) 11.3.1 (e)						x	x	x			
Pt 5, Ch 25, 11.3 Special requirements for BWTS generating dangerous gas or dealing with dangerous liquids (categories 2, 3a, 3b, 3c, 4, 5, 6, 7a, 7b and 8) 11.3.1 (f)			x	x	x				x	x	x
Pt 5, Ch 25, 11.3 Special requirements for BWTS generating dangerous gas or dealing with dangerous liquids (categories 2, 3a, 3b, 3c, 4, 5, 6, 7a, 7b and 8) 11.3.2 (a) to *Pt 5, Ch 25, 11.3 Special requirements*		x	x	x	x	x	x	x	x	x	x
Pt 5, Ch 25, 11.3 Special requirements for BWTS generating dangerous gas or dealing with dangerous liquids (categories 2, 3a, 3b, 3c, 4, 5, 6, 7a, 7b and 8) 11.3.2 (e)			x			x	x	x	x	x	x
Pt 5, Ch 25, 11.3 Special requirements for BWTS generating dangerous gas or dealing with dangerous liquids (categories 2, 3a, 3b, 3c, 4, 5, 6, 7a, 7b and 8) 11.3.2 (f)			x			x	x	x	x	x	x
Pt 5, Ch 25, 11.3 Special requirements for BWTS generating dangerous gas or dealing with dangerous liquids (categories 2, 3a, 3b, 3c, 4, 5, 6, 7a, 7b and 8) 11.3.2 (g)			x						x	x	x
Pt 5, Ch 25, 11.3 Special requirements for BWTS generating dangerous gas or dealing with dangerous liquids (categories 2, 3a, 3b, 3c, 4, 5, 6, 7a, 7b and 8) 11.3.2 (h)			x			x	x	x	x	x	x
Pt 5, Ch 25, 11.3 Special requirements for BWTS generating dangerous gas or dealing with dangerous liquids (categories 2, 3a, 3b, 3c, 4, 5, 6, 7a, 7b and 8) 11.3.3		x				x	x	x	x	x	

BWTS category	BWTS Technologies
1	In-line UV or UV + Advanced Oxidation Technology (AOT) or UV + TiO2 or UV + Plasma
2	In-line flocculation
3a	In-line membrane separation and de-oxygenation (injection of N2 from a N2 generator)
3b	In-line de-oxygenation (injection of inert gas from inert gas generator)
3c	In-tank de-oxygenation with inert gas generator
4	In-line full flow electrolysis
5	In-line side stream electrolysis
6	In-line (stored) chemical injection
7a	In-line side-stream ozone injection without gas/liquid separation tank and without discharge treatment tank
7b	In-line side-stream ozone injection with gas/liquid separation tank and discharge water treatment tank
8	In-tank pasteurisation and de-oxygenation with N2 generator

11.1.2 The BWTS is to be provided with a by-pass and isolation or override arrangement to effectively isolate it from the ship's ballast system and any essential ship system to which it is connected. The arrangement of the by-passes or overrides of the BWTS is to be consistent with the Operation Maintenance and Safety Manual approved by the Flag Administration during Type Approval.

11.1.3 The by-pass and isolation arrangements are to meet the electrotechnical requirements of *Pt 5, Ch 25, 9.1 General* as applicable.

11.1.4 When it is required to have an automatic shutdown of the BWTS for safety reasons, this must be as per *Pt 5, Ch 9.1 General 9.1.2*.

11.1.5 Under normal operating conditions of ballasting and de-ballasting given in the Ballast Water Management Plan (BWMP), the adequacy of the generating plant capacity installed on the vessel is to be demonstrated by an electrical load analysis. For retrofit installation on existing ships, a revised electrical load analysis with preferential trips of non-essential services can be accepted.

11.1.6 The BWTS is to be operated in accordance with the requirements specified in the Type Approval Certificate (TAC) issued by the Flag Administration.

11.1.7 The BWTS is to be operated within its Treatment Rated Capacity (TRC) as specified in the TAC. This may require limiting of the ship's ballast pump(s) flow rate. In case the maximum capacity of the ballast pump(s) exceeds the maximum TRC of the BWTS specified in the TAC issued by the Flag Administration, there is to be a limitation in the BWMP giving a maximum allowable flow rate for operating the ballast pump(s) that shall not exceed the maximum TRC of the BWTS.

11.1.8 The BWTS's components including pressure vessels, piping Class I or II, filters and switchboards, section boards and distribution boards are required to be designed, constructed and tested and certified as per relevant requirements of LR Rules.

11.1.9 Where a vacuum or overpressure may occur in the ballast piping or in the ballast tanks due to the height difference or injection of inert gas or nitrogen (N_2), a suitable protection device is to be provided (i.e. P/V valves, P/V breakers, P/V breather valves, pressure safety relief valves or high/low pressure alarms).
The pressure and vacuum settings of the protection device are not to exceed the design pressure of the ballast piping (BWTS categories 3a and 3b) or ballast tank (BWTS categories 3a, 3b and 3c), as applicable.
For BWTS categories 3a, 3b and 3c, the inert gas or nitrogen product enriched air from the inert gas system and from the protection devices installed on the ballast tanks (i.e. P/V valves, P/V breakers or P/V breather valves) is to be discharged to a safe location*(1) and (2) (*see Pt 5, Ch 25, 1.2 Definitions*) on the open deck.

11.1.10 When the ballast tanks are considered hazardous areas, the hazardous area is to include the outlet of the protection devices: with reference to *Pt 6, Ch 2, 14.2 Hazardous areas 14.2.5* the areas on the open deck, or semi-enclosed spaces on the open deck, within 1,5 m of their outlets are to be categorised hazardous Zone 1 and with reference to *Pt 6, Ch 2, 14.2 Hazardous areas 14.2.6* , an additional 1,5 m surrounding the 1,5 m hazardous Zone 1 is to be categorised hazardous Zone 2. Any source of ignition such as anchor windlass or opening into chain locker is to be located outside the hazardous areas. Further requirements of *Pt 6, Ch 2, 14.2 Hazardous areas* are to be complied with as applicable.

11.1.11 Where products covered by IEC 60092-502 are stored on board or generated during operation of the BWTS, the requirements of this standard are to be followed in order to:

- Define hazardous areas and acceptable electrical equipment; and
- Design ventilation systems.

11.1.12 Electric and electronic components are not to be installed in a hazardous area unless they are of certified safe type for use in the area. Cable penetrations of decks and bulkheads are to be sealed when a pressure difference between the areas is to be maintained. (*See also Pt 6, Ch 2, 14.5 Installation of electrical equipment* and *Pt 6, Ch 2, 14.9 Cable and cable installation*.)

11.1.13 Inert gas systems installed for de-oxygenation BWTS (categories 3a, 3b, 3c and 8) are to be designed in accordance with the following requirements:

(a) *International Code for Fire Safety Systems* (FSS Code), *Ch 15 Inert Gas Systems requirements*

- *Inert gas system* and *Gas-safe space* are defined in 2.1.2, 2.1.3;
- for all inert gas systems, the general requirements of sections 2.2.1.3, 2.2.1.4, 2.2.2.1, the safety measures as per 2.2.2.2, 2.2.2.3, 2.2.2.6, indicators and alarms as per 2.2.4.1 to 2.2.4.5 with the exception of clauses 2.2.4.5.1.3 and 2.2.4.5.3;
- for flue gas and inert gas generator systems, the system requirements of sections 2.3.1.1.2, 2.3.1.2, 2.3.1.4.2, 2.3.1.5, 2.3.1.6 with the exception of clause 2.3.2.2.1;
- for nitrogen generator systems, the system requirements 2.4.1.3, 2.4.1.4 and 2.4.2.

(i) For inert gas systems installed for in-tank de-oxygenation BWTS (category 8): the requirements of 2.2.3.1, 2.2.3.2 except 2.2.3.2.6, 2.2.3.2.7 and 2.2.3.2.10.
In general, when applying FSS Code Ch 15 requirements to inert-gas based BWTS, the following modifications are to be considered:

- The terms 'cargo tank' and 'cargo piping' are to be replaced by 'ballast water tank' or 'ballast water piping' as relevant;
- The term 'cargo control room' is to be replaced by 'BWTS control station' as relevant;
- Requirements for slop tanks on combination carriers are to be disregarded;
- When applying FSS Code 15.2.2.4.5.1.1, the acceptable oxygen content is to be specified by the manufacturer. 5 per cent oxygen content need not necessarily be applied.

(b) *Pt 5, Ch 15, 7 Inert gas systems on Tankers of 8,000 tonnes DWT and above* as applicable. The terms 'cargo tanks' and 'cargo piping' are to be understood as 'ballast tanks' and 'ballast piping' respectively. For de-oxygenation BWTS (categories 3a, 3b, 3c and 8), the requirements in *Pt 5, Ch 25, 11.1 General requirements 11.1.13.(a)* prevail.

11.1.14 When cavitation is the BWTS treatment process or part of the BWTS treatment process, the design and the wall thickness or grade of materials or inside coating or surface treatment of the part of the piping where the cavitation is taking place is to be specifically considered.

Existing sub-Section 11.2 has been deleted and replaced by below.

11.2 Additional requirements for tankers

11.2.1 Hazardous area classification is to be in accordance with *Pt 6, Ch 2, 14.2 Hazardous areas*.

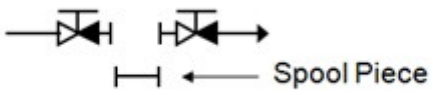
11.2.2 BWTS using ozone generators (categories 7a and 7b) and de-oxygenation BWTS using inert gas generator with treated flue gas from main or auxiliary boilers or gas from an oil or gas-fired gas generator (categories 3b and 3c) are to be located outside the cargo area in accordance with Section 2.3.1.1.2 of FSS Code Ch 15. This requirement does not apply to inert gas generators for which FSS Code Ch 15/2.4.1 and *Pt 5, Ch 15, 7 Inert gas systems on Tankers of 8,000 tonnes DWT and above*.

11.2.3 In-line full flow electrolysis BWTS (category 4), in-line side-stream electrolysis BWTS (category 5) and in-line injection BWTS using a chemical which is stored on board (category 6) can be located inside the hazardous areas with due consideration of the requirement of *Pt 5, Ch 25, 9.1 General 9.1.10*, but are not be located inside the cargo pump-room unless it is demonstrated by the BWTS manufacturer that the additional hazards that could be expected from dangerous liquids and dangerous gases stored or evolved from the BWTS:
(a) do not lead to an upgrade of the hazardous area categorisation of the cargo pump-room;
(b) are not reactive with the cargo vapours expected to be present in the cargo pump-room;
(c) are not reactive with the fire-extinguishing medium provided inside the cargo pump-room;
(d) are not impacting the performance of the existing fire-fighting systems provided inside the cargo pump-room;
(e) are not introducing additional hazards inside the cargo pump-room, such as toxicity hazards that would not have been prior addressed by suitable counter measures.

11.2.4 In case two independent BWTS systems are not fitted, one for ballast tanks located within the cargo area and the other one for ballast tanks located outside cargo area non-hazardous areas are not to be rendered hazardous by the use of the BWTS or its connections with the ballast system. Specific arrangements where only one single In-line BWTS (categories 1, 2, 3a, 3b, 4, 5, 6, 7a and 7b) could be accepted are given in Section 13.

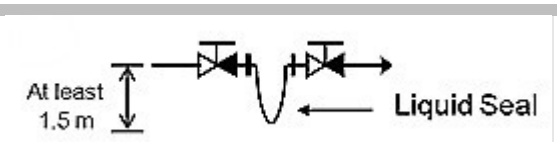
11.2.5 The transfer of ballast water from hazardous to non-hazardous areas is not permitted except for sampling, *see Pt 5, Ch 25, 11.2 Additional requirements for tankers 11.2.7*. Ballast arrangements on ships carrying liquefied gases in bulk will be subject to special consideration.

11.2.6 Isolation between the ballast piping serving the ballast tanks inside the cargo area and that serving the ballast tanks outside the cargo area is to be in accordance with the following requirements:
(a) Interconnection between the ballast piping serving the ballast tanks located within the cargo area and the ballast piping serving the ballast tanks located outside the cargo area may be accepted if an appropriate isolation arrangement is provided.
(b) The means of appropriate isolation described in *Pt 5, Ch 25, 11.2 Additional requirements for tankers 11.2.6 (c)* is necessary for the interconnection in the case of active substance piping such as N_2 gas piping, inert gas piping, neutraliser piping, fresh water piping for filter cleaning, compressed air piping for remaining water purge and sea water piping for adjusting the salinity, etc. regardless of the diameter of the piping. For active substance piping and neutraliser piping (both up to DN50) only, alternative isolation arrangements, preferably on the open deck, offering equivalent safety and gas tightness may be considered for penetration of the bulkhead separating the non-hazardous machinery space from a hazardous area (such as the cargo pump-room) at as high an elevation in the machinery space as possible, preferably just below the main deck. The arrangements are to provide suitable protection measures in addressing the pollution hazards and safety concerns due to the potential migration of hydrocarbons or flammable or toxic liquids or vapours from the hazardous areas.
The means of appropriate isolation described in *Pt 5, Ch 25, 11.2 Additional requirements for tankers 11.2.6 (c)* need not be applied to the sampling lines described in *Pt 5, Ch 25, 11.2 Additional requirements for tankers 11.2.7*.
(c) The means of appropriate isolation is to be one of the following:
(i) Two non-return valves with positive means of closing in series with a spool piece (also mentioned 'means of dis-connection' in Annex I); or



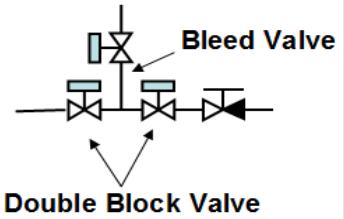
Note As an alternative to positive means of closure, an additional valve having such means of closure may be provided between the non-return valve and the spool piece.

(ii) Two non-return valves with positive means of closing in series with a liquid seal at least 1,5 m in depth; or



Note As an alternative to positive means of closure, an additional valve having such means of closure may be provided between the non-return valve and the liquid seal.
Note 2. For ships operating in cold weather conditions, freeze protection should be provided in the water seal. A portable heating system can be accepted for this purpose.

(iii) Automatic double block and bleed valves and a non-return valve with positive means of closing.



Note As an alternative to positive means of closure, an additional valve having such means of closure may be provided after the non-return valve.

(d) The above-mentioned means of appropriate isolation in *Pt 5, Ch 25, 11.2 Additional requirements for tankers 11.2.6 (c)* is to be provided on the open deck in the cargo area.

Note 1. When the fore peak tank is ballasted with the piping system serving the other ballast tanks within the cargo area, the means of appropriate isolation *Pt 5, Ch 25, 11.2 Additional requirements for tankers 11.2.6 (c)* and *Pt 5, Ch 25, 11.2 Additional requirements for tankers 11.2.6 (d)* are not required in-between the fore peak tank and the common ballast water piping serving the other ballast water tanks within the cargo area.

11.2.7 Sampling lines which are connected to the ballast water piping system serving the tanks in the cargo area and provided for the purpose of the following:

- any BWTS: ballast water sampling required by the G2 Guideline of the BWM Convention (2004); or
- BWTS categories 4, 5, 6, 7a and 7b: total residual oxidant (TRO) analysis in closed loop system;

are not to be led into a non-hazardous enclosed space outside the cargo area. However, the sampling lines may lead into a non-hazardous enclosed space outside the cargo area provided the following requirements are fulfilled:

(a) The sampling facility (for BWTS monitoring/control) is to be located within a gastight enclosure (hereinafter referred to as a 'cabinet'), and the following (i) through (iv) are to be complied with.
  (i) In the cabinet, a stop valve is to be installed on each sampling line.
  (ii) Gas detection equipment is to be installed in the cabinet and the valves specified in (i) above are to be automatically closed upon activation of the gas detection equipment.
  (iii) Audible and visual alarm signals are to be activated both locally and at the BWTS control station when the concentration of explosive gases reaches a pre-set value, which is not to be higher than 30 per cent of the lower flammable limit (LFL). Upon activation of the alarm, all electrical power to the cabinet is to be automatically disconnected. When the electrical equipment is of a certified safety type, the automatic disconnection of power the supply is not required.
  (iv) The cabinet is to be vented to a safe location (*see Pt 5, Ch 25, 1.2 Definitions*) in a non-hazardous area on the open deck and the vent is to be fitted with a flame arrester.

(b) The standard internal diameter of sampling pipes is to be the minimum necessary in order to achieve the functional requirements of the sampling system.

(c) The cabinet is to be installed as close as possible to the bulkhead facing the cargo area, and the sampling lines located outside the cargo area are to be routed on their shortest paths.

(d) Stop valves are to be located in the non-hazardous enclosed space outside the cargo area, on both the suction and return lines close to the penetrations through the bulkhead facing the cargo area. A warning plate stating 'Keep valve closed when not performing measurements' is to be posted near the valves. Furthermore, in order to prevent backflow, a water seal or equivalent arrangement is to be installed on the hazardous area side of the return pipe.

(e) A stop valve is to be installed on the cargo area for each sampling line (i.e. both the suction line and the return line).

(f) The samples which are extracted from the ballast water piping system serving the tanks within the cargo area are not to be discharged to a tank located outside the cargo area and are not to discharge to a piping line supplying the spaces located outside the cargo area.

(g) Pipes are to be manufactured from steel or equivalent and be protected against mechanical damage.

(h) The ballast water sampling/analysis unit is to meet electrotechnical requirements of *Pt 5, Ch 25, 9.1 General* as applicable.

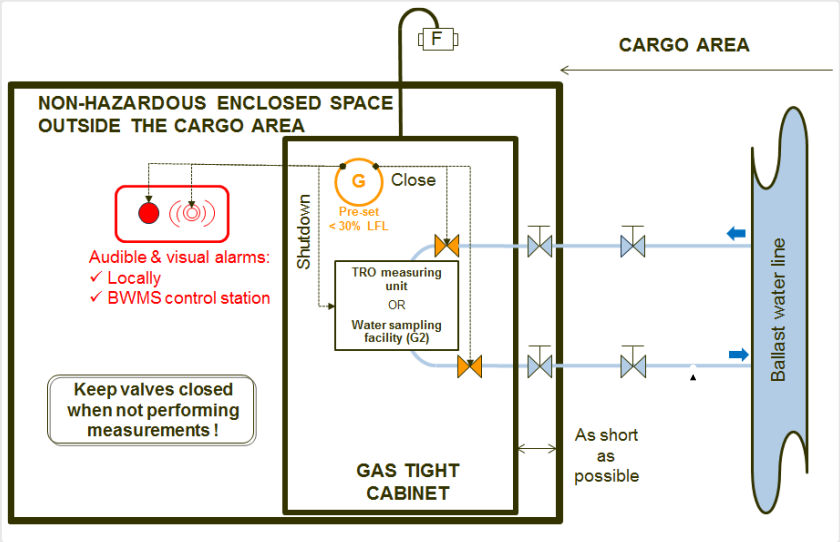


Figure 25.11.1 Ballast water sampling/analysis

Existing sub-Section 11.3 has been deleted and replaced with below.

11.3 Special requirements for BWTS generating dangerous gas or dealing with dangerous liquids (categories 2, 3a, 3b, 3c, 4, 5, 6, 7a, 7b and 8)

11.3.1 Where the operating principle of the BWTS involves the generation of a dangerous gas, the following requirements are to be satisfied:

(a) **Gas detection in spaces:** Gas detection equipment is to be fitted in the spaces where dangerous gas could be present, and an audible and visual alarm is to be activated both locally and at the BWTS control station in the event of leakage.

The gas detectors are to be located as close as possible to the BWTS components where the dangerous gas may accumulate.

For flammable gases and explosive atmosphere including but not limited to hydrogen, the construction, testing and performance of the gas detection devices is to be in accordance with IEC 60079-29-1, IEC 60079-29-2, IEC 60079-29-3 and/or IEC 60079-29-4, as applicable.

Where other hazards are considered, such as toxicity, asphyxiation, corrosive and reactivity hazards, a recognised standard acceptable to LR is to be selected with due consideration of the specific gases to be detected and due consideration of the performance of the detection device with regards to the specific atmosphere where it is used.

(b) **Oxygen sensors:** In spaces where inert gas generator systems are fitted (BWTS categories 3b and 3c) or nitrogen generators are fitted (BWTS categories 3a and 8), at least two oxygen sensors are to be positioned at appropriate locations (as required by paragraph 2.2.4.5.4 of Chapter 15 of the FSS Code as amended by IMO resolutions up to MSC.410(97)) to trigger an alarm when the oxygen level falls below 19 per cent. The alarms are to be both audible and visual and are to be activated inside the space, at the entry into the space and inside the BWTS control station.
For BWTS categories 7a and 7b, at least two oxygen sensors are to be positioned at appropriate locations in the following spaces. Spaces where ozone generators are fitted; spaces where ozone destructors are fitted; or spaces where ozone piping is routed.to trigger an alarm when the oxygen level rises above 23 per cent. The alarms are to be both audible and visual and are to be activated inside the space, at the entry into the space, and inside the BWTS control station.
Automatic shutdown of the BWTS is to be arranged when the oxygen level rises above 25 per cent. Audible and visual alarms independent from those specified in the preceding paragraph are to be activated prior to this shutdown.

(c) **Ozone sensors:** For BWTS categories 7a and 7b, at least one ozone sensor is to be provided in the vicinity of the discharge outlet to the open deck from the ozone destructors addressed in *Pt 5, Ch 25, 1.2 Definitions 1.2.5* to trigger an alarm when the ozone concentration level rises above 0,1 ppm. The alarm is to be both audible and visual and is to be activated in the BWTS control room. In addition, at least two ozone sensors are to be positioned at appropriate locations in the following spaces: spaces where ozone generators are fitted; spaces where ozone destructors are fitted; or spaces where ozone piping is routed.
These sensors are to trigger an alarm when the ozone concentration level rises above 0,1 ppm. The alarms are to be both audible and visual and shall be activated at the following locations: inside the space; at the entry into the space; and inside the BWTS control room.
Automatic shutdown of the BWTS is to be arranged when the ozone concentration measured from any one or both of the two sensors inside the space rises above 0,2 ppm.

(d) **Gas detection in double walled pipes or pipe ducts:** Inside double walled spaces or pipe ducts required by *Pt 5, Ch 25, 11.3 Special requirements for BWTS generating dangerous gas or dealing with dangerous liquids 11.3.2 (a)(i)*, sensors are to be provided for the detection of hydrogen leakages (BWTS categories 4, 5 and 6 when relevant) or oxygen leakages (BWTS

categories 7a and 7b) or ozone leakages (BWTS categories 7a and 7b). The sensors are to activate an alarm at the high concentration level settings and automatic shutdown of the BWTS at the high-high concentration level settings described in *Pt 5, Ch 25, 11.3 Special requirements for BWTS generating dangerous gas or dealing with dangerous liquids 11.3.1(a)* to *Pt 5, Ch 25, 11.3 Special requirements for BWTS generating dangerous gas or dealing with dangerous liquids 11.3.1(c)*.
Note As an alternative to the sensor for the gas detection, monitored under-pressurisation inside the double walled spaces or pipe ducts may be provided with an alarm and automatic shutdown of the BWTS in case of loss of the under-pressurisation. This may be achieved by monitoring the pressure inside the double walled spaces or pipe ducts.

(e) **Hydrogen:** For in-line full flow electrolysis BWTS (category 4), in-line side-stream electrolysis BWTS (category 5) and in-line injection BWTS using a chemical which is stored on board (category 6): the hydrogen de-gas arrangement (when provided) is to be provided with redundant ventilation fans and redundant monitoring of the ventilation system.
In addition, the ventilation fan is to be certified explosion proof and have a spark arrestor to prevent ignition sources entering the ventilation system where hydrogen may be present in explosive concentrations.
Audible and visual alarms and automatic shutdown of the BWTS are to be arranged for respectively high and high-high levels of hydrogen concentration. The open end of the hydrogen by-product enriched gas relieving device is to be led to a safe location*(3) (*see Pt 5, Ch 25, 1.2 Definitions*) on the open deck.

(f) **Vents:** The open ends of the inert gas or nitrogen gas enriched air (BWTS categories 3a, 3b, 3c and 8) or oxygen-enriched air vent pipes (BWTS categories 3a, 7a, 7b and 8) are to be led to a safe location*(1) and (2) (*see Pt 5, Ch 25, 1.2 Definitions*) on the open deck.

11.3.2 Where the piping is conveying active substances, by-products or neutralisers that contain dangerous gas or dangerous liquids as defined respectively in *Pt 5, Ch 25, 1.2 Definitions*, the following requirements are to be satisfied:
Note This requirement is applicable to the injection lines conveying the dangerous gas or dangerous liquids but not applicable to the ballast waterlines where the dangerous gas or dangerous liquids are diluted.

(a) The piping is to be of either Class I without special safeguard or Class II with special safeguard as listed below, irrespective of design pressure and temperatures (*see Pt 5, Ch 12, 1.6 Classes of piping systems and components*). The selected materials, the testing of the material, the welding, the non-destructive tests of the welding, the type of connections, the hydrostatic tests and the pressure tests after assembly on board are to be as required in *Pt 5, Ch 12, Piping Design Requirements*. Mechanical joints, where allowed, are to be selected in accordance with *Table 12.2.8 Application of mechanical joints depending on class of piping*.
  (i) For piping Class II with special safeguards conveying a dangerous gas such as hydrogen (H_2), oxygen (O_2) or ozone (O_3), the special safeguards are to be either double walled pipes or pipe ducts.
  (ii) For piping Class II with special safeguards conveying dangerous liquids, other special safeguards could be considered such as shielding, screening, etc.
  (iii) Plastic pipes may be accepted after due assessment of the dangerous gas or dangerous liquids conveyed inside. When plastic pipes are accepted, the requirements of *Pt 5, Ch 12, Section 5 Plastic Pipes* apply.

(b) The length of pipe and the number of connections are to be minimised.

(c) Inside double walled space or pipe ducts required by *Pt 5, Ch 25, 11.3 Special requirements for BWTS generating dangerous gas or dealing with dangerous liquids 11.3.2 (a)(i)* is to be equipped with mechanical exhaust ventilation leading to a safe location*(3) and (4) (*see Pt 5, Ch 25, 1.2 Definitions*) on the open deck.

(d) The routing of the piping system is to be kept away from any sources of heating or ignition and any other sources that could react hazardously with the dangerous gas or liquid conveyed inside. The pipes are to be suitably supported and protected from mechanical damage.

(e) Pipes carrying acids are to be arranged so as to avoid any projection onto crew in case of a leakage.

(f) Hydrogen (H_2) by-product enriched air vent pipes (BWTS categories 4, 5 and 6) or oxygen (O_2) enriched air vent pipes (BWTS categories 3a, 7a, 7b and 8) or ozone (O_3) piping (BWTS categories 7a and 7b) are not to be routed through accommodation spaces, services spaces and control stations.

(g) Oxygen (O_2) enriched air vent pipes (BWTS categories 3a, 7a, 7b and 8) are not to be routed through hazardous areas unless they are arranged inside double walled pipes or pipe ducts required by *Pt 5, Ch 25, 11.3 Special requirements for BWTS generating dangerous gas or dealing with dangerous liquids 11.3.2 (a)(i)* and provided with suitable gas detection as described in *Pt 5, Ch 25, 11.3 Special requirements for BWTS generating dangerous gas or dealing with dangerous liquids 11.3.1(d)* and mechanical exhaust ventilation as described in *Pt 5, Ch 25, 11.3 Special requirements for BWTS generating dangerous gas or dealing with dangerous liquids 11.3.2(c)*.

(h) The routing of hydrogen (H_2) by-product enriched air vent pipes (BWTS categories 4, 5 and 6) or oxygen (O_2) enriched air vent pipes (BWTS categories 3a, 7a, 7b and 8) is to be as short and as straight as possible. When required, horizontal portions are to be arranged with a minimum slope in accordance with the manufacturer's recommendation.

11.3.3 For BWTS using chemical substances or dangerous gases which are stored on board for either:

- storage or preparation of the active substances (BWTS categories 2 and 6);
- storage or preparation of the neutralisers (BWTS categories 4, 5, 6, 7a and 7b); or
- recycling the wastes produced by the BWTS (BWTS category 2);

handling procedures are to be in accordance with the Material Safety Data Sheet and BWM.2/Circ.20 *Guidance to ensure safe handling and storage of chemicals and preparations used to treat ballast water and the development of safety procedures for risks to the ship and crew resulting from the treatment process*, and the following measures are to be taken as appropriate:

(a) The materials or inside coating used for the chemical storage tanks, piping and fittings are to be resistant to such chemical substances.

(b) Chemical substances (even if they are not defined as dangerous according to *Pt 5, Ch 25, 1.2 Definitions*) and gas storage tanks are to be designed, constructed, tested, inspected, certified and maintained in accordance with:

- for independent tanks permanently fixed on board containing dangerous liquids (e.g. sulphuric acid, H_2SO_4) or dangerous gas (e.g. oxygen, O_2) the LR Rules for pressure vessels of Class I or II as applicable, *see Pt 5, Ch 11 Other Pressure Vessels*;
- for independent tanks permanently fixed on board not containing dangerous liquids (e.g. sodium sulphite, sodium biosulphite or sodium thiosulfphate neutralisers) and not containing dangerous gas (e.g. nitrogen, N2): the Classification Rules or other industry standard recognised by the Classification Society;
- for portable tanks: the IMDG Code or other industry standard recognised by the Classification Society;
- Atmospheric storage tanks will be considered for non-hazardous and non-toxic chemicals not requiring inert gas blanketing and with negligible vapour pressure.

(c) When the chemical substances are stored inside integral tanks, the ship's shell plating is not to form any boundary of the tank.

(d) Dangerous liquids and dangerous gas storage tank air pipes are to be led to a safe location*(1) and (2) (*see Pt 5, Ch 25, 1.2 Definitions*) on the open deck.

(e) An operations manual containing chemical injection procedures, alarm systems, measures in case of emergency, etc. is to be provided and kept on board.

(f) Dangerous liquid storage tanks and their associated components, such as pumps and filters, are to be provided with spill trays or a secondary containment system of sufficient volume to contain potential leakages from tank openings, gauge glasses, pumps, filters and piping fittings.

Further to the safety and/or pollution assessment of the concerned chemical substances, consideration is to be provided for segregation of the drains from such spill trays (or secondary containment system) or piping systems from the engine room bilge system or from the cargo pump-room bilge system, as applicable. When necessary, arrangement is to be provided within the spill trays (or within the secondary containment system) for the detection of dangerous liquid or dangerous gas as defined respectively in *Pt 5, Ch 25, 1.2 Definitions*.

Note: The IMO reports issued during the basic and final approval procedures of the BWTS that make use of active substances (G9 Guideline) and / or the Marine Safety Data Sheet (MSDS) could be used for this assessment.

Existing sub-Section 11.4 has been deleted.

■ *Section 12*
Fire safety requirements

Existing sub-Section 12.1 has been deleted and replaced by below.

12.1 Application

12.1.1 The purpose of this Section is to provide details of fire safety measures, in addition to those required by SOLAS Chapter II-2, related to the installation of BWTS on board any ship.

12.1.2 The requirements apply to BWTS technologies as listed in *Table 25.1.1 Categorisation of BWTS technologies*. BWTS with alternative technologies are to be specially considered.

12.1.3 BWTS storing, introducing or generating chemicals. In general, BWTS storing, introducing or generating chemicals refer to:

- In-line flocculation (category 2 as per *Table 25.1.1 Categorisation of BWTS technologies*; and
- BWTS technologies using neutraliser injection (category 4, 5, 6 and 7 as per *Table 25.1.1 Categorisation of BWTS technologies*.

BWTS that do not store, introduce or generate toxic or flammable chemicals may be specially considered as detailed in *Table 25.12.1 Requirements that may be reduced for BWTS storing, introducing or generating chemicals depending on the chemicals*.

Table 25.12.1 Requirements that may be reduced for BWTS storing, introducing or generating chemicals depending on the chemicals

Requirement	Conditions to be met before reducing the requirement
Pt 5, Ch 25, 12.2 Fire categorisation 12.2.3 (d)	The stored chemicals are neither toxic nor flammable
Pt 5, Ch 25, 10.3 BWTR location and boundaries 10.3.1 (a)	The BWTS does not use any flammable or toxic chemical substances
Pt 5, Ch 25, 10.3 BWTR location and boundaries 10.3.3 (a)	No dangerous gas as defined in *Pt 5, Ch 25, 1.2 Definitions* will be generated by the BWTS
Pt 5, Ch 25, 10.4 Ventilation 10.4.1 (a)	No toxic chemical is stored and no toxic gas will be generated by the BWTS

Pt 5, Ch 25, 12.5 Personal equipment 12.5.1 *Pt 5, Ch 25, 12.5 Personal equipment 12.5.3* *Pt 5, Ch 25, 12.5 Personal equipment 12.5.6*	No toxic chemical is used or will be generated by the BWTS
Note: Chemicals include additives for BWTS.	

12.2 Fire categorisation

12.2.1 General

BWTR shall be classified as follows for the purpose of applying the requirements of SOLAS Chapter II-2:

- BWMR containing oil-fired inert gas generators (i.e. BWTS category 3b and 3c as per *Table 25.1.1 Categorisation of BWTS technologies*) shall for the purposes of structural fire protection be categorised as space type (12)- (machinery spaces and main galleys) according to SOLAS II-2/2.2.3 for passenger ships carrying greater than 36 passengers, or machinery spaces of category A (6) according to SOLAS II-2 9.2.2.4, II-2 9.2.3.3 and II-2 9.2.4 for other ship types.

- BWMR containing other systems shall, for the purposes of structural fire protection, be categorised as space type (11) - Other machinery spaces according to SOLAS II-2 2.2.3 for passenger ships carrying greater than 36 passengers or as space type (11) – auxiliary machinery spaces according to SOLAS II-2/9.2.2.3 or space type (7) according to SOLAS II-2/9.2.2.4, II-2/9.2.3 and II-2/9.2.4 for other ship types.

12.2.2 BWTS located in the cargo area of tankers

Notwithstanding the above, where a BWTS is located in the cargo area of a tanker, the BWTR is to be categorised as (8), a cargo pump-room, according to SOLAS Chapter II-2, Regulation 9.2.4.2.2 for determining the extent of fire protection to be provided.
Note The cargo area of a tanker is defined in *Pt 5, Ch 25, 1.2 Definitions*.

12.2.3 Storage of chemicals

(a) Spaces where the storage of liquid or solid chemicals for BWTS is intended are to be categorised as store-rooms for the purpose of applying the requirements of SOLAS Chapter II-2, i.e.:

- On passenger ships carrying more than 36 passengers:

'Other spaces in which flammable liquids are stowed' as defined in SOLAS Chapter II-2, Regulation 9.2.2.3.2.2(14), if flammable products are stored;
'Store-rooms, workshops, pantries, etc.' as defined in SOLAS Chapter II-2, Regulation 9.2.2.3.2.2(13) otherwise.

- On other ships:
  - 'Cargo pump-rooms' as defined in SOLAS Chapter II-2, Regulation 9.2.4.2.2.2(8) if located in the cargo area of a tanker;
  - 'Service spaces (low risk)' as defined in SOLAS Chapter II-2, Regulation 9.2.2.4.2.2(5), SOLAS Chapter II-2, Regulation9.2.3.3.2.2(5) or Chapter II-2, Regulation 9.2.4.2.2.2(5) if the surface area is less than 4 m^2 and if no flammable products are stored;
  - 'Service spaces (high risk)' as defined in SOLAS Chapter II-2, Regulation 9.2.2.4.2.2(9), SOLAS Chapter II-2, Regulation 9.2.3.3.2.2(9) or Chapter II-2, Regulation 9.2.4.2.2.2(9) otherwise.

Note It is understood that only chemical injection (category 6 as per *Table 25.1.1 Categorisation of BWTS technologies*), in-line flocculation (category 2 as per *Table 25.1.1 Categorisation of BWTS technologies*) and technologies using neutraliser injection (category 4, 5, 6 and 7 as per *Table 25.1.1 Categorisation of BWTS technologies*) will require chemical or additive storage.

(b) Where the storage of chemicals is foreseen in the same room as the ballast water treatment machinery, this room is to be considered both as a store-room and as a machinery space in line with *Pt 5, Ch 25, 12.2 Fire categorisation 12.2.1.* Where spaces have dual categorisation the higher category of fire protection shall be applied.

(c) When the chemical substances are stored inside integral tanks, the ship's shell plating is not to form any boundary of the tank.

(d) Tanks containing chemicals are to be segregated from accommodation, service spaces, control stations, machinery spaces not related to the BWTS and from drinking water and stores for human consumption by means of a cofferdam, void space, cargo pump-room, empty tank, oil fuel storage tank, BWTR or other similar space. On-deck stowage of permanently attached deck tanks or installation of independent tanks in otherwise empty hold spaces should be considered as satisfying this provision.

12.3 Fire fighting

12.3.1 Fixed fire-extinguishing system

(a) Where fitted, fixed fire-extinguishing systems are to comply with the relevant provisions of SOLAS II-2, Regulation 10 and the Fire Safety Systems Code.

(b) Ozone-based BWTS
BWTR containing equipment related to ozone-based BWTS is to be provided with a fixed fire-extinguishing system suitable for category A machinery spaces and capable of manual release.

(c) Where a fixed fire-extinguishing system is provided in the BWTR, it is to be compatible with the BWTS and the chemical products that are used, produced or stored in the BWTR. Specific attention is to be paid to potential chemical reactions between the fire-extinguishing medium and chemical products used for water treatment.
Especially, water-based fire-extinguishing systems should be avoided in case of sulphuric acid storage.

(d) Foam fixed fire-extinguishing system
For all kinds of BWTS, in case a foam fire-extinguishing system is installed in the BWTR, its efficiency is not to be impaired by chemicals used by the BWTS where relevant.

(e) Where a fixed fire-extinguishing system is installed in the BWTR, automatic shutdown of the BWTS upon release of the fixed fire-extinguishing system is to be arranged. Any need for cooldown necessary for safe shutdown is to be considered in the shutdown sequence.
(f) Where BWTS that includes air or O_2 storage is located in a room covered by a fixed gas fire-extinguishing system, the discharge pipes from safety valves for air or O_2 storage are to be led directly outside the protected space.

12.3.2 Portable fire-fighting equipment
(a) There is to be at least one portable fire-extinguisher that complies with the provisions of the Fire Safety Systems Code and is suitable for use with the type of the BWTS installed, e.g. suitable for electrical fires in the BWTR containing UV-type BWTS.

12.4 Fire prevention

12.4.1 Fire detection
(a) A fixed fire detection and fire alarm system complying with the provisions of the Fire Safety Systems Code is to be installed in spaces containing an inert gas generator or an ozone generator. The type of fixed fire detection system is to be selected considering the nature of the risk and ambient conditions and any outcome from the risk assessment process.
(b) A section of fire detectors which covers a control station, a service space or an accommodation space is not to include a BWMR containing equipment related to ozone-based BWTS.

12.5 Personal equipment

12.5.1 Suitable protection equipment is to be available on board for the protection of the crew members who are engaged in the servicing, maintenance and repair of BWTS storing, introducing or generating chemicals, as recommended by the product manufacturers. The protection equipment is to consist of large aprons, special gloves with long sleeves, suitable footwear, coveralls of chemical-resistant materials, and tight-fitting goggles or face shields or both. The protective clothing and equipment is to cover all skin so that no part of the body is unprotected. This protection equipment is to be provided separately without taking into account equipment required by other mandatory statutory requirements.

12.5.2 Work clothes and protective equipment are to be kept in easily accessible places and in special lockers. Such equipment is not to be kept within accommodation spaces, with the exception of new, unused equipment and equipment which has not been used since undergoing a thorough cleaning process. Notwithstanding the above, storage rooms for such equipment within accommodation spaces are to be adequately segregated from living spaces such as cabins, passageways, dining rooms, bathrooms, etc.

12.5.3 When a BWTS storing, introducing or generating chemicals is installed on board, suitably marked decontamination showers and an eyewash is to be available in a convenient location close proximately to the BWTS and the chemical storeroom(s).

12.5.4 An emergency escape breathing apparatus (EEBD) is to be provided in the BWTR. Where the BWTS is located in a common space, such as a main engine room, this EEBD may be one of the EEBDs provided in accordance with the requirements of SOLAS Chapter II-2, Regulation 13.
An EEBD is not required for BWTS of category 1 as per *Table 25.1.1 Categorisation of BWTS technologies*.

12.5.5 A personal ozone detector, calibrated as per the manufacturer's specifications, is to be provided for each person engaged in the servicing, maintenance and repair of BWTS utilising ozone.

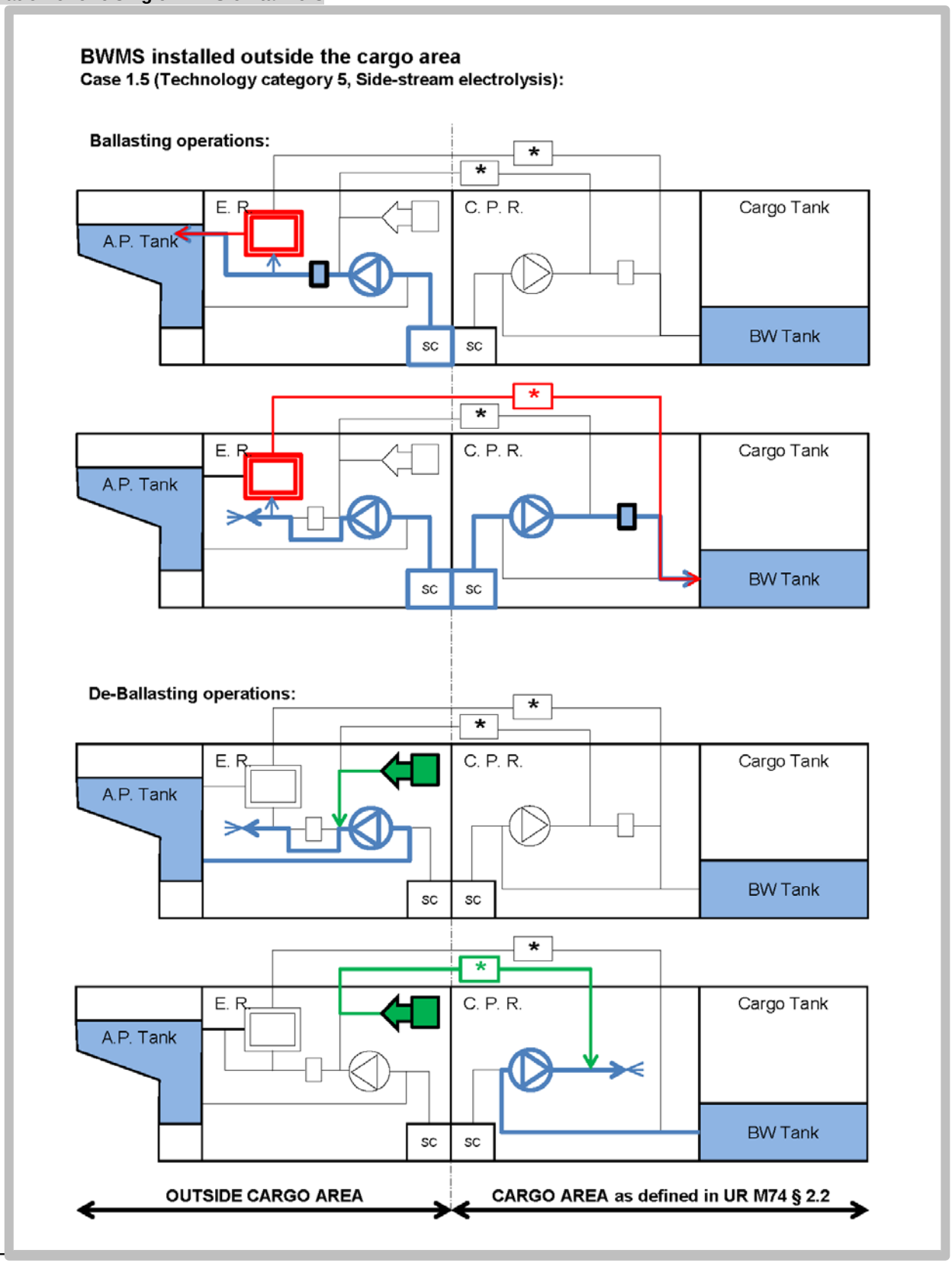
12.5.6 A two-way portable radiotelephone apparatus dedicated for the BWTS service, maintenance and repair is to be provided, in addition to those required by SOLAS for fire-fighting purposes. This two-way radiotelephone apparatus is to be properly identified in order to avoid mix-up with the apparatus intended for fire-fighting operations. Where the BWTS may release explosive gases, this two-way radiotelephone apparatus is to be of a certified safe type suitable for use in Zone 1 hazardous areas, as defined in IEC 60079. Where the BWTS stores, utilises or introduces chemicals, the apparatus is to undergo deep cleaning or decontamination after use.
A two-way portable radiotelephone apparatus need not be required for BWTS of category 1 as per *Table 25.1.1 Categorisation of BWTS technologies*.

12.5.7 The fire control plan is to include the items specified in *Pt 5, Ch 25, 12.3 Fire fighting and 12.5 Personal equipment.*

■ *Section 13*

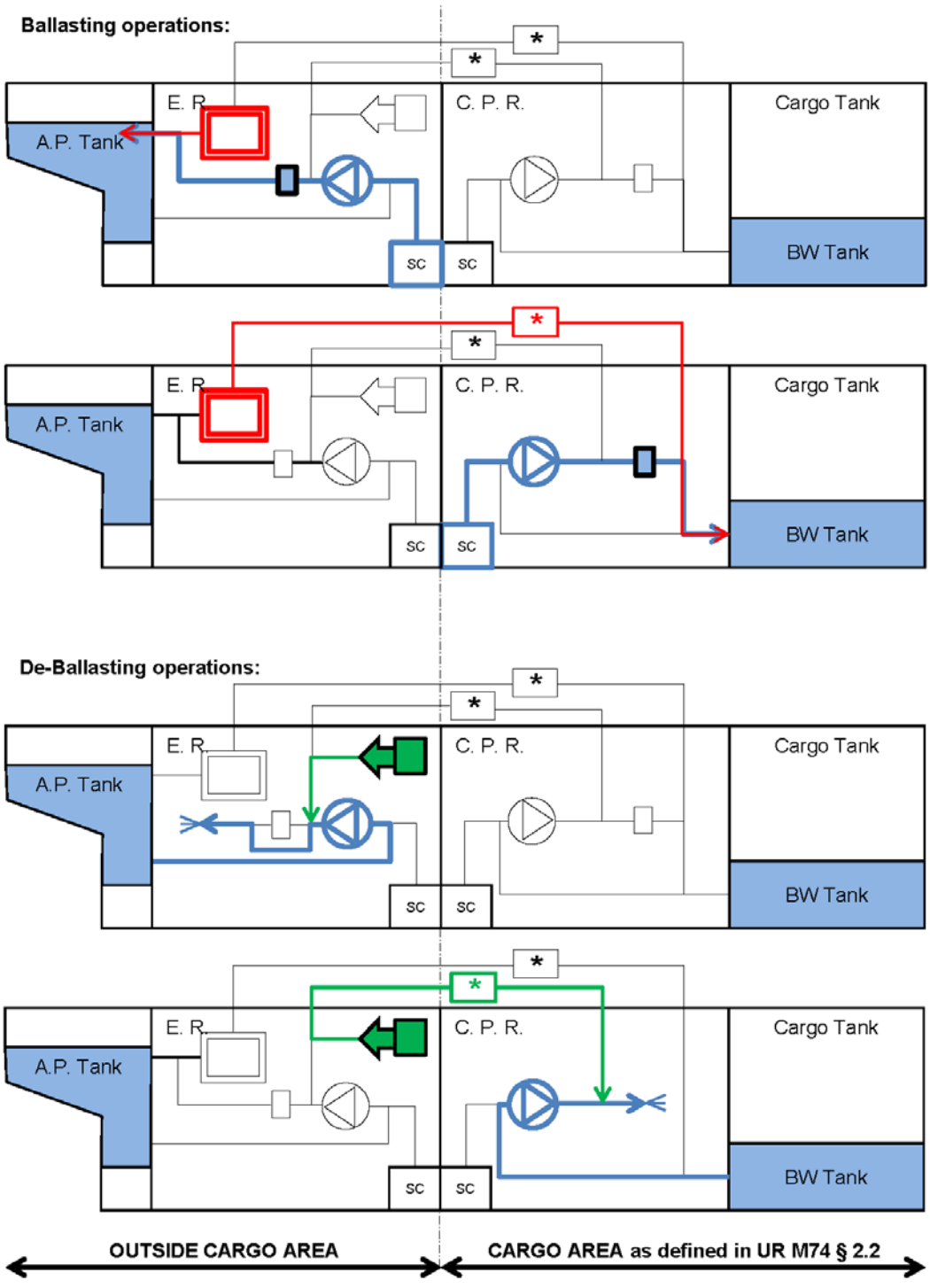
BWTS Installation arrangements

13.1 Installation of one single BWTS on tankers



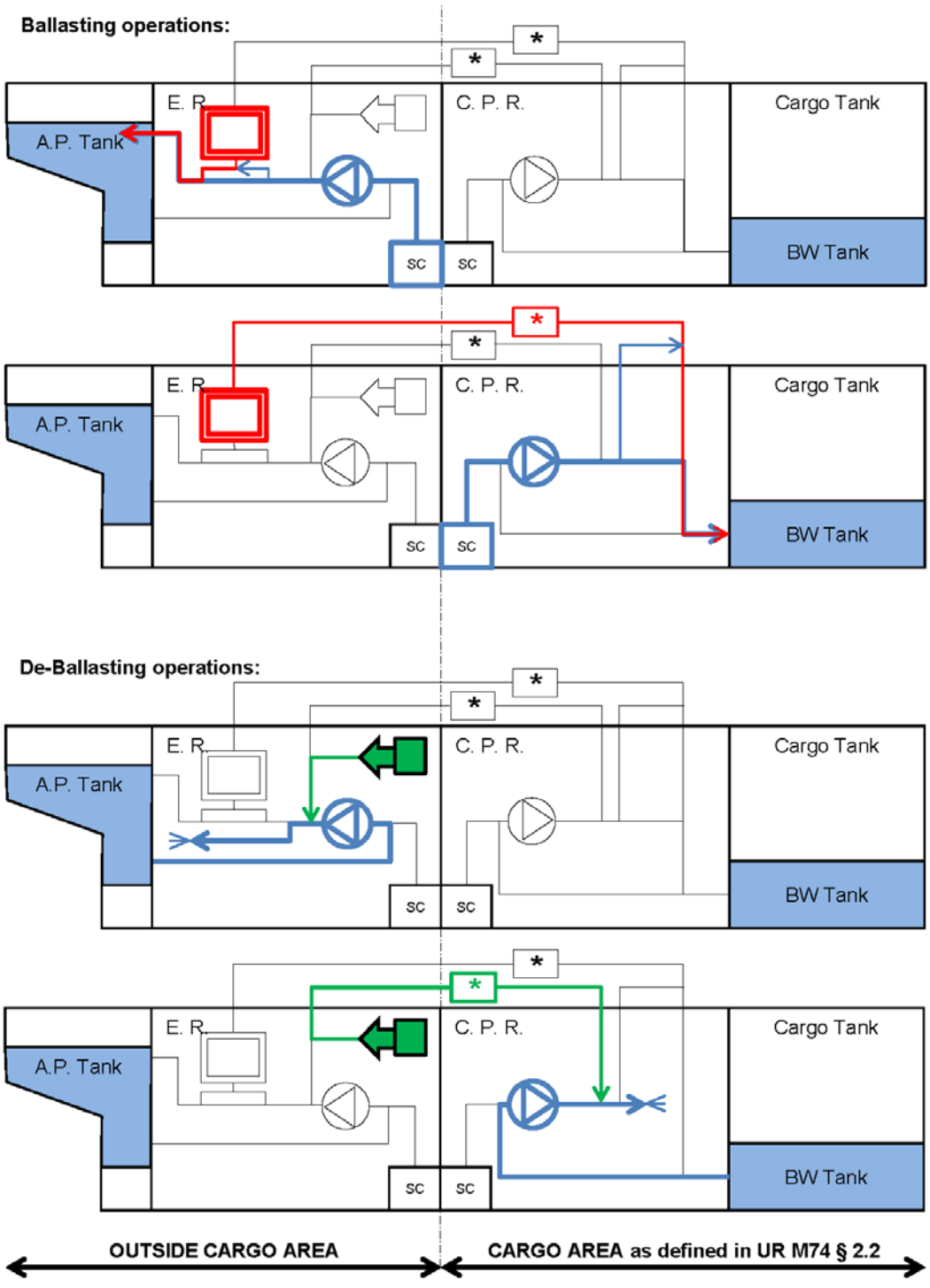
BWMS installed outside the cargo area

Case 1.6 (Technology category 6, Stored chemical injection)



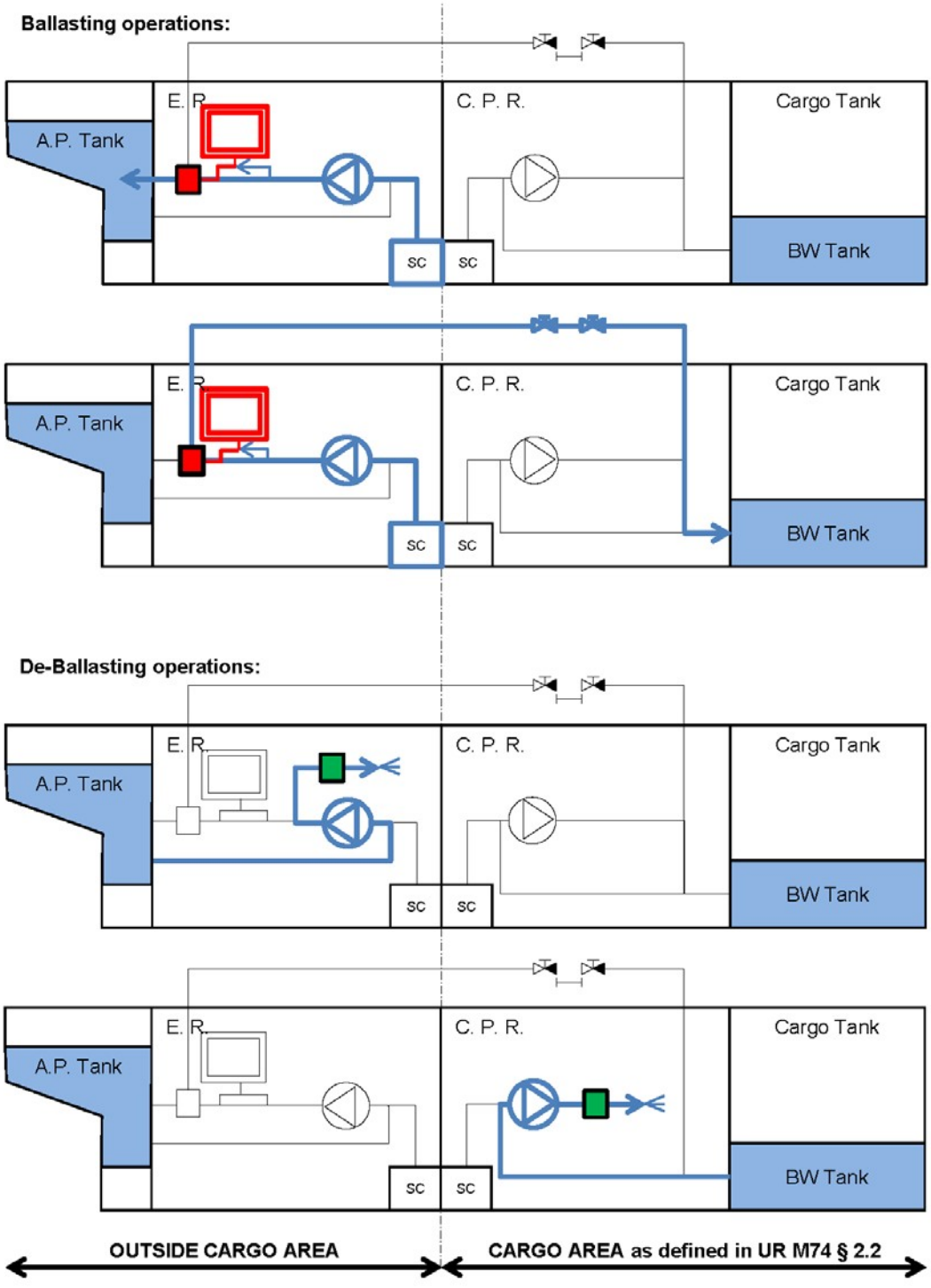
BWMS installed outside the cargo area

Case 1.7a (Technology category 7a, Side-stream ozone injection without gas/liquid separation tank and without discharge water treatment tank):



BWMS installed outside the cargo area

Case 1.7b (Technology category 7b, Side-stream ozone injection with gas/liquid separation tank and discharge water treatment tank):

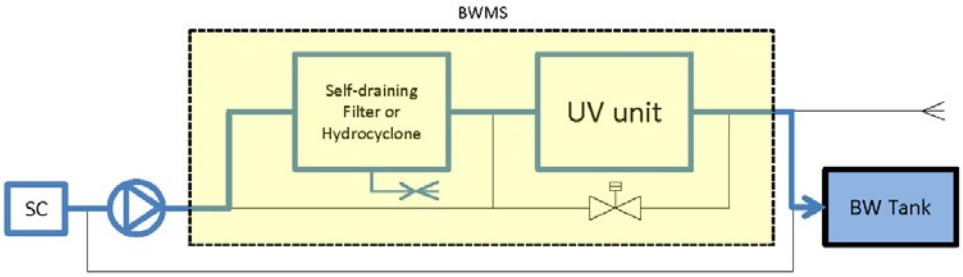


13.2 BWTS Technologies categorization (INFORMATIVE)

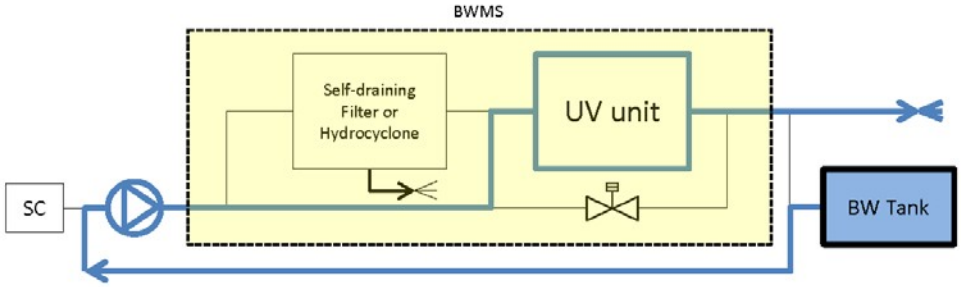
Annex II (INFORMATIVE)
BWMS Technologies categorization

BWMS Technology Group no. 1
In-Line UV
including UV + AOT
Including UV+TiO2)

Ballasting operation:

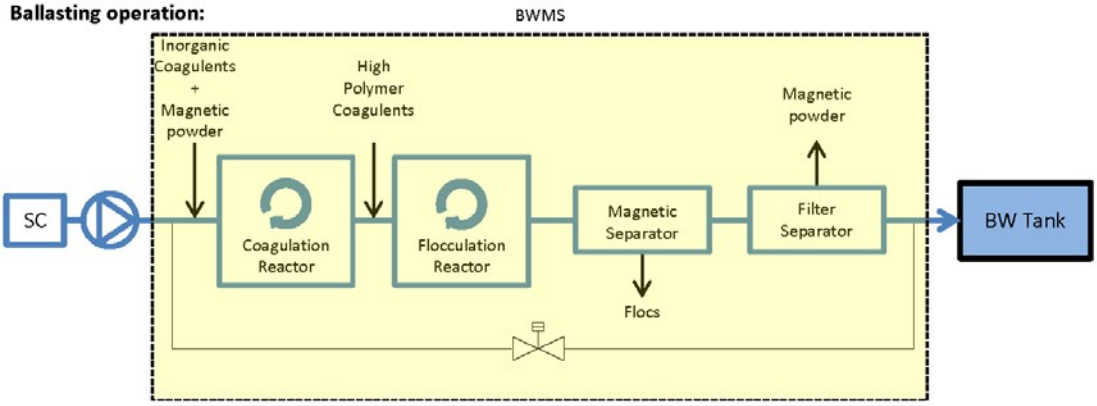


De-ballasting operation:



BWMS Technology Group no. 2
In-Line Flocculation

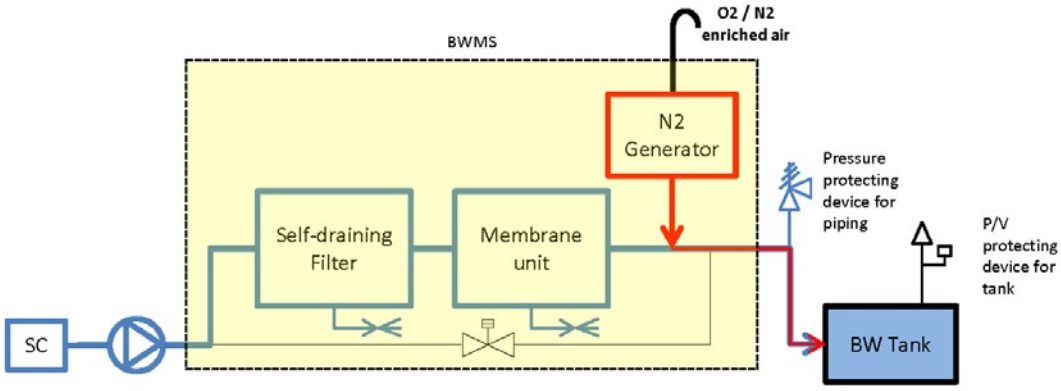
Ballasting operation:



De-ballasting operation: no requirement for after-treatment

BWMS Technology Group no. 3a
In-Line membrane separation and de-oxygenation
(injection of N2 from N2 Generator)

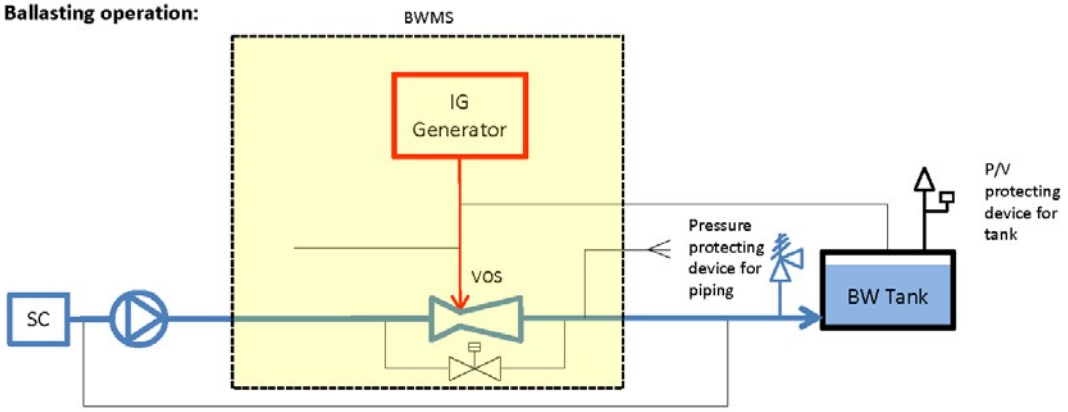
Ballasting operation:



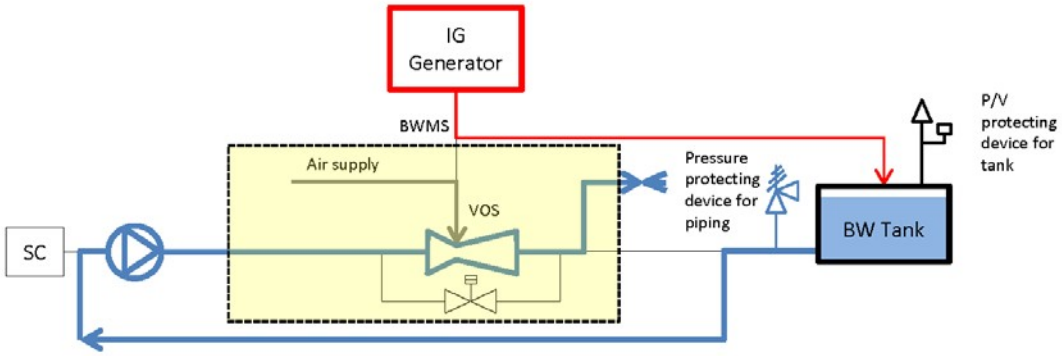
De-ballasting operation: no requirement for after-treatment

BWMS Technology Group no. 3b
In-Line de-oxygenation
(injection of inert gas from either an oil fired inert gas generator or inert gas from treatment of the flue gas from main or auxiliary boilers)

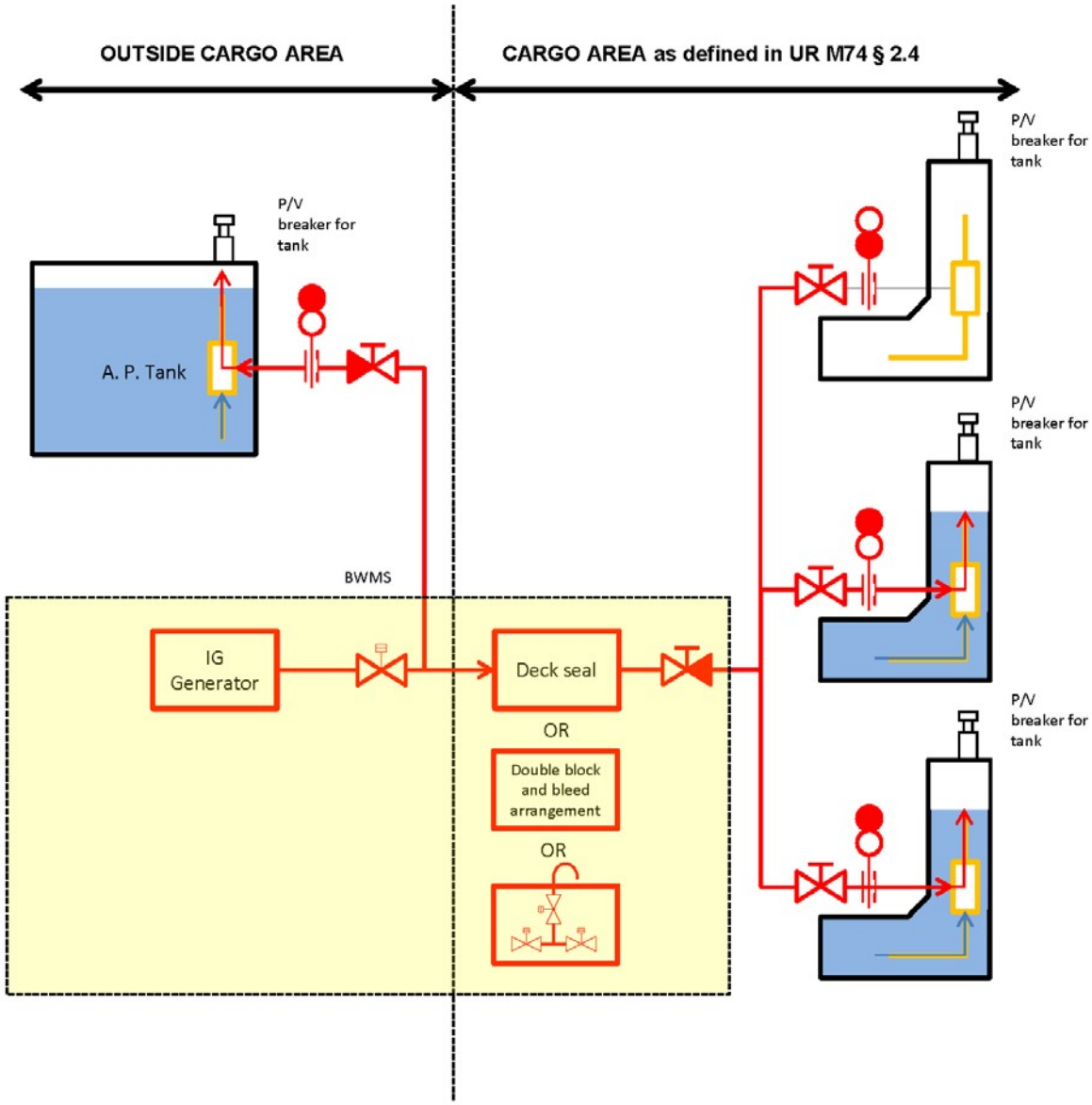
Ballasting operation:



De-ballasting operation:

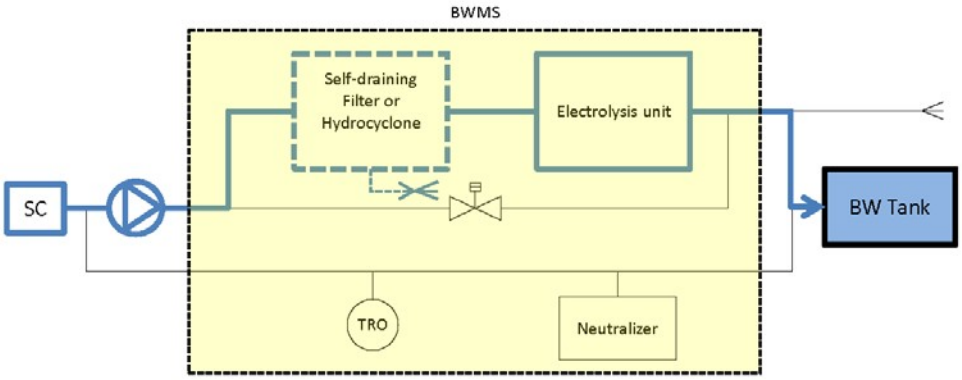


BWMS Technology Group no. 3c
In-tank de-oxygenation with IGG

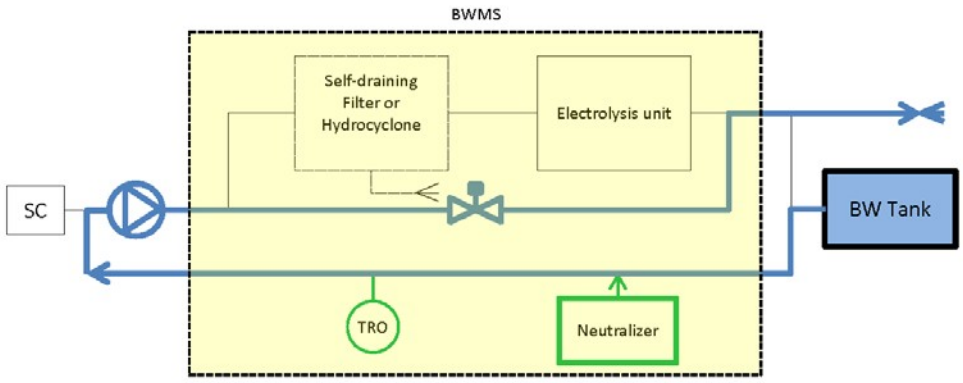


BWMS Technology Group no. 4
In-Line Full flow electrolysis

Ballasting operation:



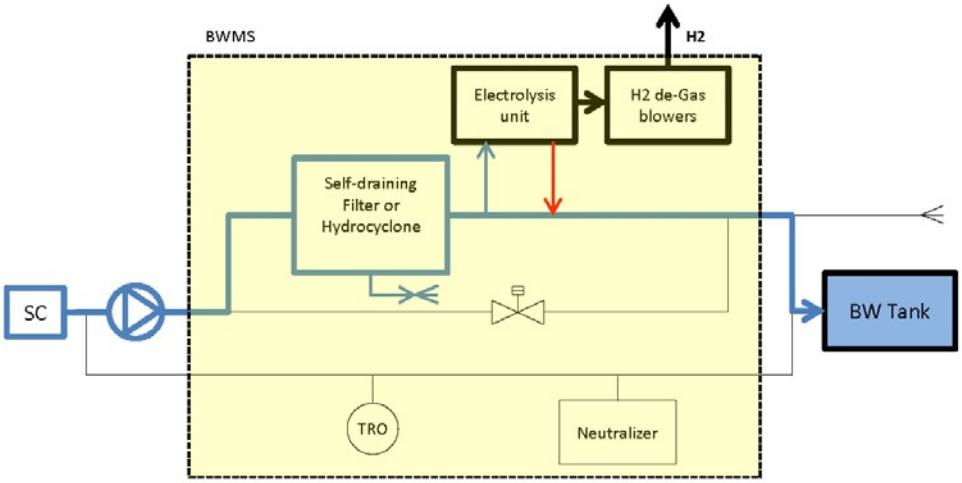
De-ballasting operation:



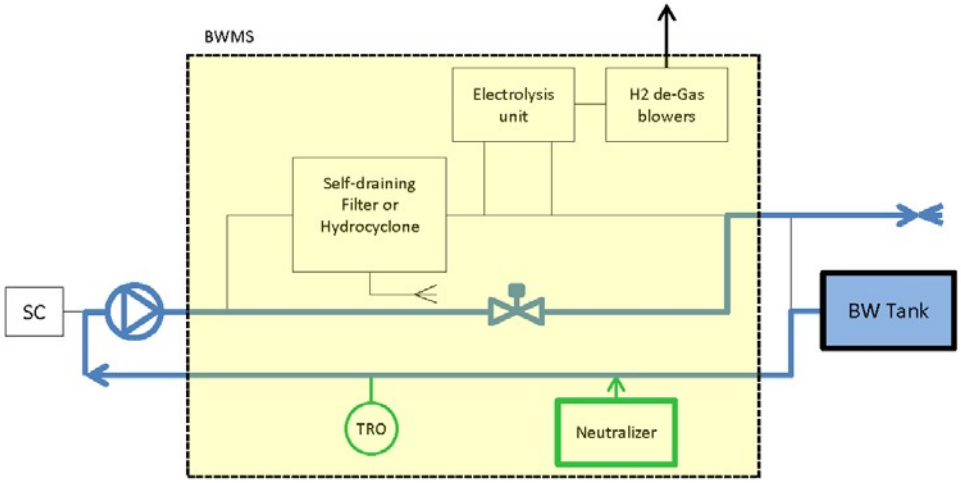
BWMS Technology Group no. 5
In-Line Side-Stream electrolysis (electro-chlorinization)

Note: In-line side stream electrolysis may also be applied in-tank in circulation mode (no treatment when ballasting or de-ballasting)

Ballasting operation:

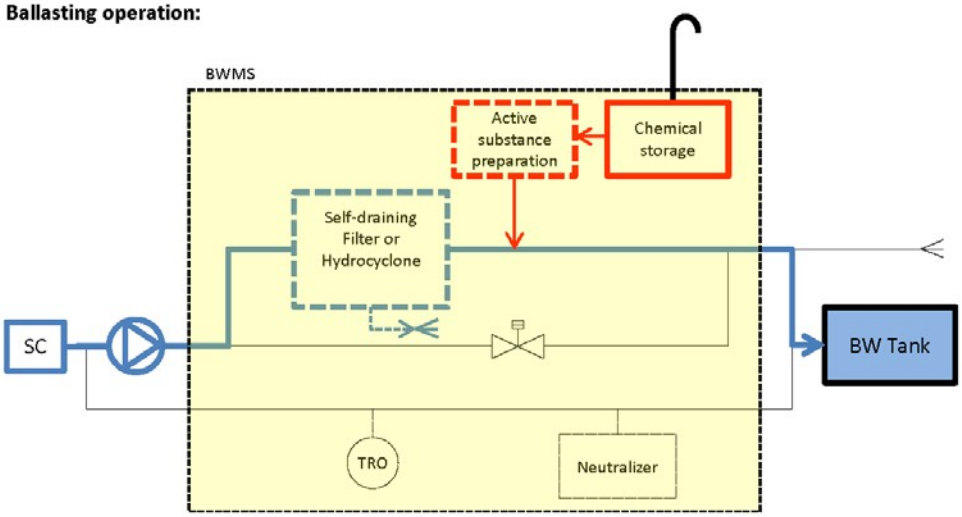


De-ballasting operation:

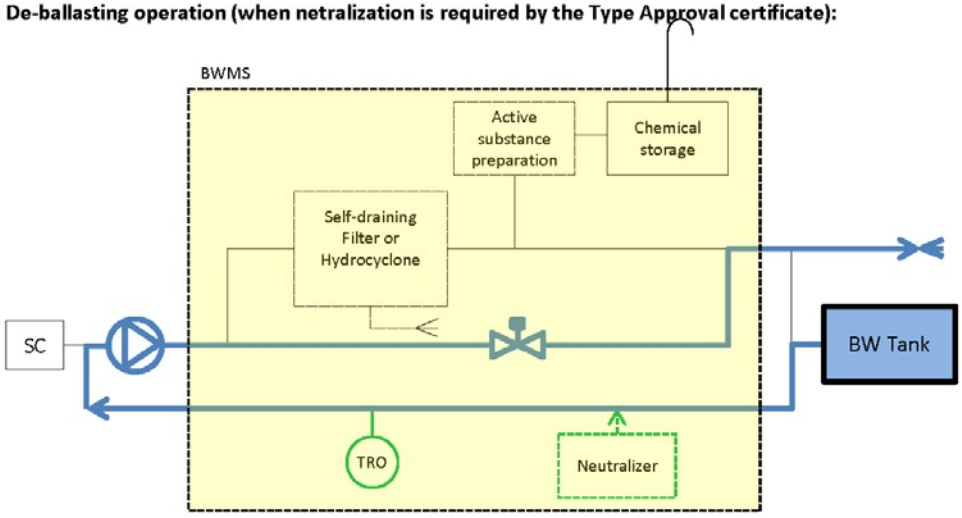


BWMS Technology Group no. 6
In-Line Chemical injection

Ballasting operation:

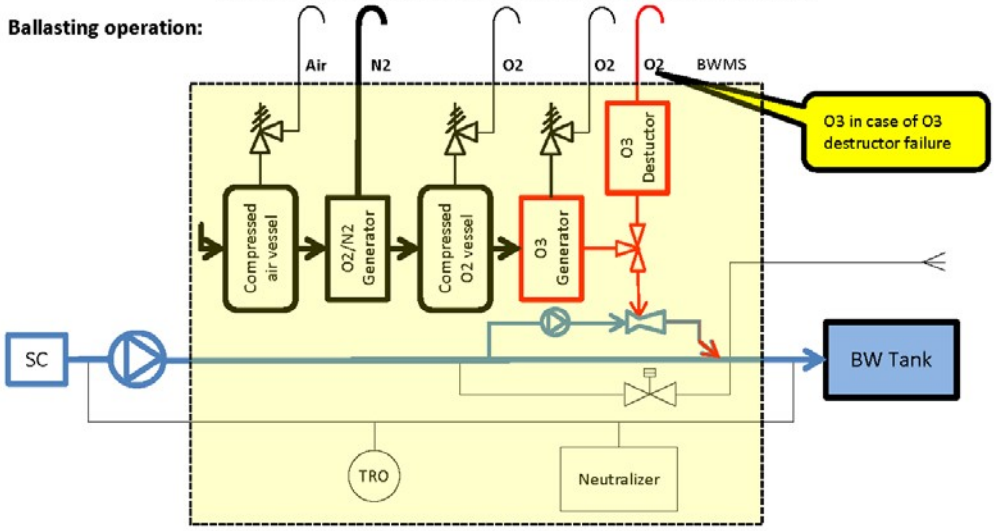


De-ballasting operation (when netralization is required by the Type Approval certificate):

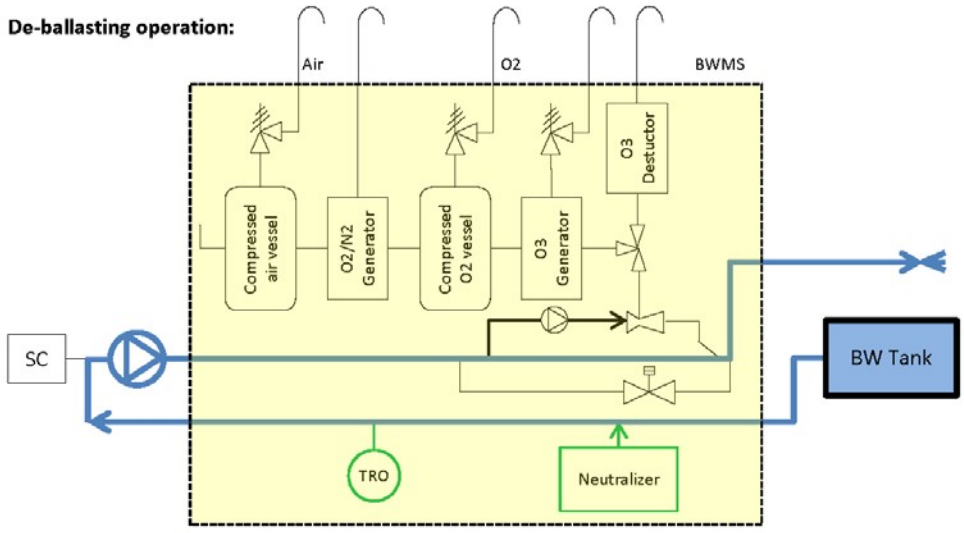


BWMS Technology Group no. 7a
In-Line Side-stream Ozone injection without gas/liquid separation tank and without discharge water treatment tank

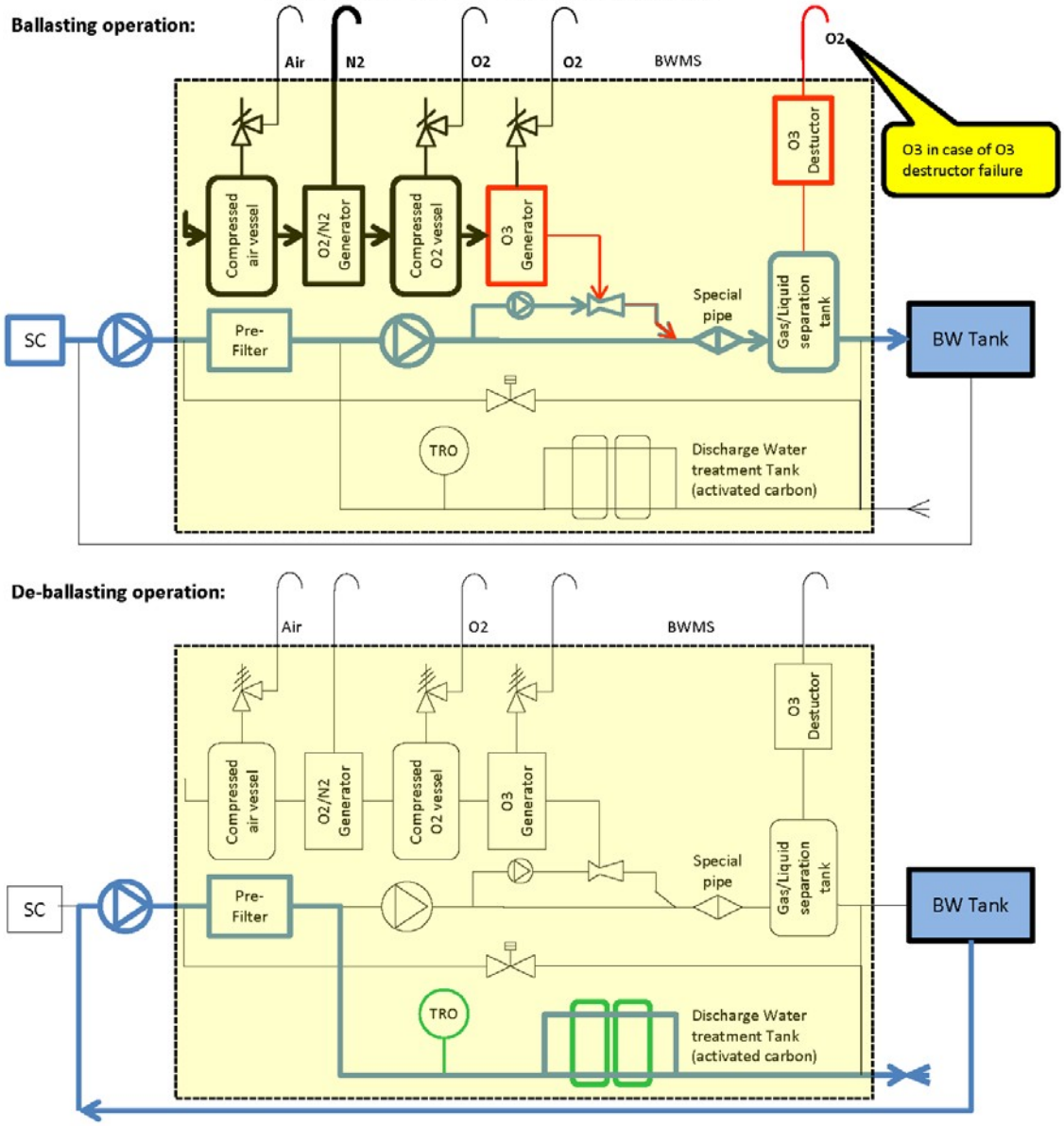
Ballasting operation:



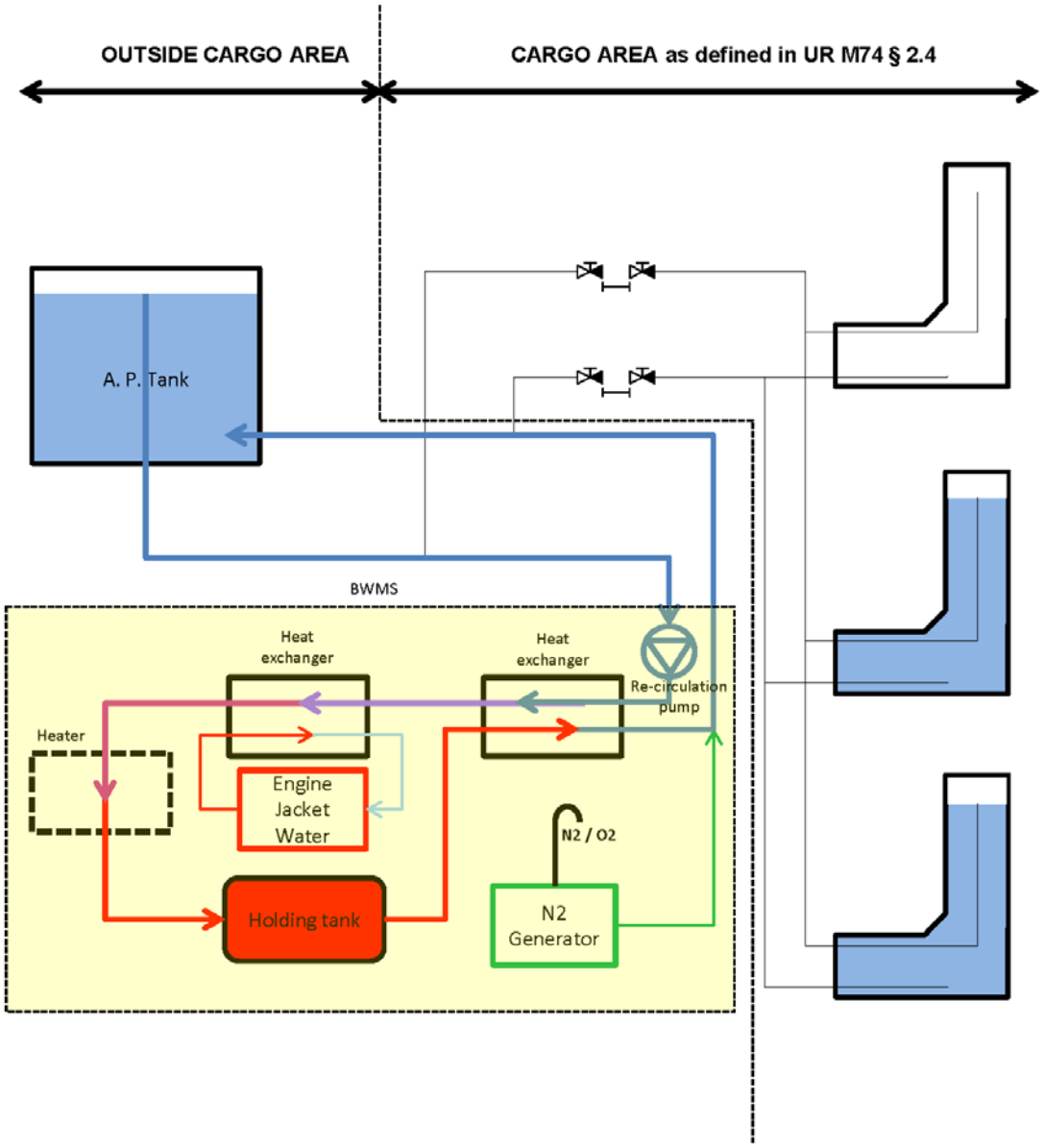
De-ballasting operation:



BWMS Technology Group no. 7b
In-Line Side-stream Ozone injection with gas/liquid separation tank and with discharge water treatment tank



BWMS Technology Group no. 8
In-tank Pasteurization + de-oxygenation with N2 Generator



Part 6, Chapter 2
Electrical Engineering

■ *Section 2*
Main source of electrical power

2.2 Number and rating of generators and converting equipment

(Part only shown)

2.2.1 Under sea-going conditions, the number and rating of service generating sets and converting sets, such as transformers and semi-conductor converters, when any one generating set or converting set is out of action, are:

(c) to be capable of providing the electrical services necessary to start the main propulsion machinery from a dead ship condition in accordance with SOLAS ~~Ch~~ Chapter II-1, Part D, *Regulation 41 - Main source of electrical power and lighting systems*, Section 1.4.

■ *Section 14*
Electrical equipment for use in explosive gas atmospheres or in the presence of combustible dusts

14.2 Hazardous areas

14.2.1 Hazardous areas and sources of hazard for ships intended for the carriage in bulk of oil cargoes, liquefied gases, other flammable liquid cargoes, the special requirements for ships with spaces for carrying vehicles with fuel in their tanks for their own propulsion, the special requirements for ships intended for the carriage of dangerous goods and materials hazardous only in bulk and the requirements for ships with spaces for storing paint, are defined (either directly, or by reference to other documents) in *Pt 6, Ch 2, 14.10 Requirements for tankers intended for the carriage in bulk* to *Pt 6, Ch 2, 14.15 Requirements for ships with spaces for storing paint.* A hazardous area is an area in which an explosive gas atmosphere is or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of electrical equipment.

14.2.2 Non-hazardous area means an area which is not a hazardous area as defined in *Pt 6, Ch 2, 14.2 Hazardous areas 14.2.1*.

Existing paragraphs 14.2.2 to 14.2.8 have been renumbered 14.2.3 to 14.2.9.

14.9 Cable and cable installation

14.9.1 Electric cables are not, as far as is practicable, to be installed in hazardous areas, except where serving equipment installed within the area. Through runs of cable may be accepted in locations classified as ~~**zone 1**~~ **Zone 1** or ~~**zone 2**~~ **Zone 2**, where alternative routes are impracticable.

(Part only shown)

14.9.2 In addition to the requirements of *Pt 6, Ch 2, 11 Electric cables, optical fibre cables and busbar trunking systems (busways)*, cables for circuits that are not intrinsically safe, which are located in hazardous areas, or which may be exposed to cargo oil, oil vapour or gas, are to be either:

(b) otherwise adequately protected against mechanical or chemical damage, within ~~**zone 2**~~ **Zone 2** or non-hazardous locations only, or

14.9.6 In ~~**zone 0**~~ **Zone 0**, cable joints may only be used in intrinsically safe circuits.

(Part only shown)

14.9.7 Cable runs in ~~**zone 1**~~ **Zone 1** or ~~**zone 2**~~ **Zone 2** are, where practicable, to be uninterrupted. Where discontinuities cannot be avoided, cable joints are to:

14.9.8 Cable penetrations of decks and bulkheads are to be sealed when a pressure difference between the areas is to be maintained.

Part 7, Chapter 11
Arrangements and Equipment for Environmental Protection (ECO Class Notation)

■ *Section 1*
General requirements

1.2 ECO class notation: minimum requirements and additional characters

(Part only shown)

1.2.2 *Pt 7, Ch 11, 3 Supplementary characters* contains additional requirements. Ships complying with these requirements will be eligible for one or more of the following associated supplementary characters, as applicable:

IBTS Integrated Bilge Water Treatment System.

~~**NO_{x3}** Nitrogen Oxides (NOx) exhaust emissions.~~

OW Oily bilge water.

1.5 Information to be submitted

(Part only shown)

1.5.5 Information and plans:

(c) Description of the method(s) by which the NOx certified value has been achieved and the NOx Technical File for the engine plus the NOx reducing device ~~(NOx-$_3$ supplementary character).~~

(w) ~~Details of grey water treatment plant and effluent quality (for supplementary **GW** character only).~~

For supplementary **GW** character only, the following plans are to be provided:

- Drawings showing the grey water and sewage system arrangements;
- Treatment system manual and documentation demonstrating that the grey water system meets the requirements for thermotolerant coliforms, total suspended solids, biochemical oxygen demand, chemical oxygen demand, and pH (if treatment system fitted);
- Document showing the grey water holding tank is of adequate capacity.

■ *Section 3*
Supplementary characters

3.5 Energy Efficiency Design Index – EEDI-3 characters

3.5.1 The 'attained' Energy Efficiency Design Index is to be established in accordance with ~~the 2012 Guidelines on the method of calculation of attained EEDI for new ships (Resolution MEPC.203(62) – Amendments to the Annex of the Protocol of 1997 to Amend the International Convention for the Prevention of Pollution from Ships...)~~ *Resolution MEPC.308(73) - 2018 Guidelines on the Method of Calculation of the Attained Energy Efficiency Design Index (EEDI) for New Ships - (adopted on 26 October 2018)* and verified in accordance with LR's procedure for verifying EEDI values.

Existing sub-Section 3.9 has been deleted in its entirety.

Existing sub-Sections 3.10 to 3.15 have been renumbered 3.9 to 3.14.

Published by Lloyd's Register Group Limited
Registered office (Reg. no. 08126909)
71 Fenchurch Street, London, EC3M 4BS
United Kingdom